PUBLIC DOCUMENT . . . . . No. 71.

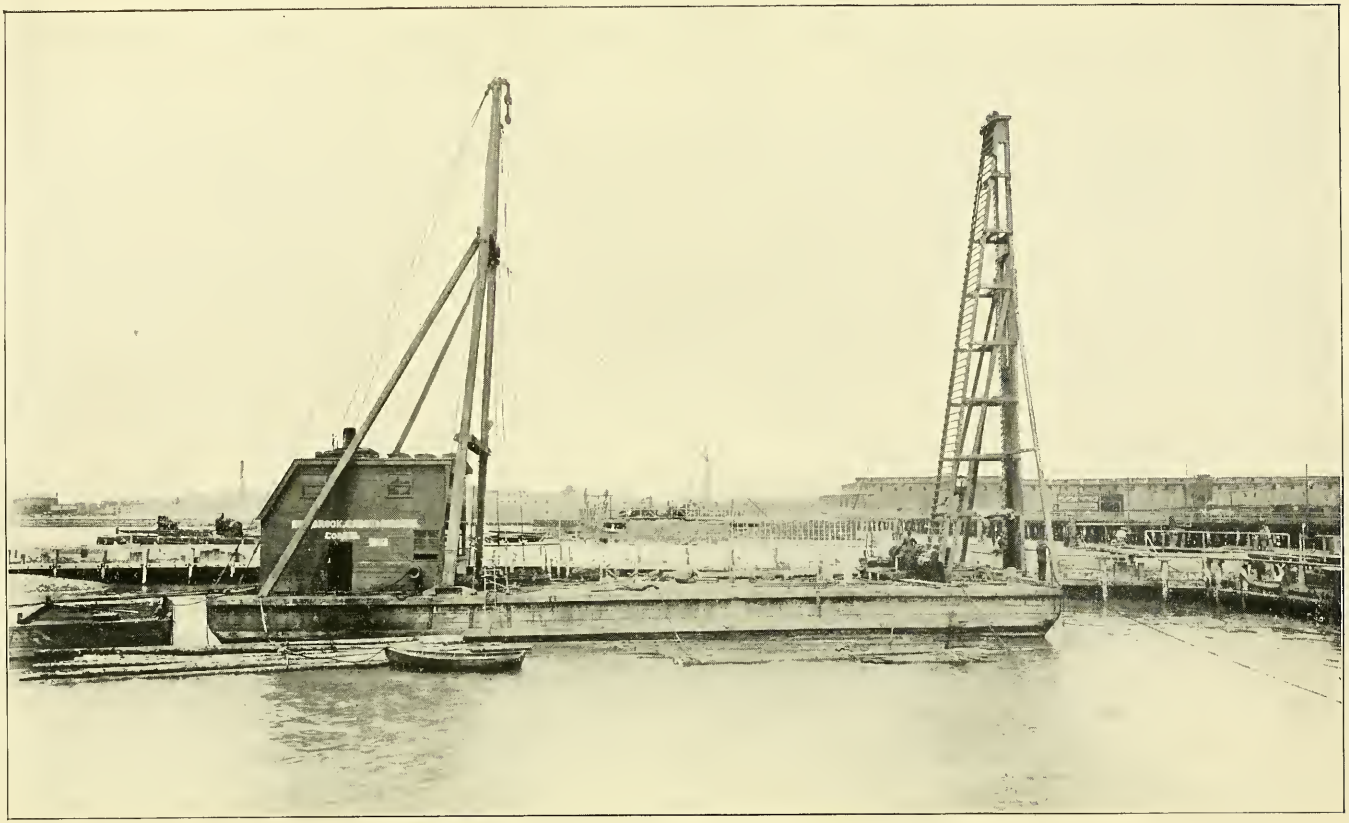
THIRD ANNUAL REPORT

OF THE

CHARLES RIVER BASIN COMMISSION.

OCTOBER 1, 1905.

BOSTON:
WRIGHT & POTTER PRINTING CO., STATE PRINTERS,
18 POST OFFICE SQUARE.
1906.



DAM AND LOCK — Driving Foundation Piles for Lock.

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APPROVED BY

THE STATE BOARD OF PUBLICATION.

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ILLUSTRATIONS.

Commonwealth of Massachusetts.

THIRD REPORT OF THE COMMISSION.

To His Excellency the Governor and the Honorable Council of the Commonwealth of Massachusetts.

The Commission appointed under chapter 465 of the Acts of the year 1903, called the Charles River Basin Commission, has the honor to make the following report of its proceedings and expenditures. As required by the Revised Laws, this report is for the year ending Sept. 30, 1905.

I. Organization and Administration.

(*a*) *The Commission, Officers and Employees.*

The membership of the Commission remains the same as in the preceding year: Henry S. Pritchett, chairman, Henry D. Yerxa and Joshua B. Holden. William S. Youngman has continued as secretary, and Hiram A. Miller as chief engineer.

The administrative office force has remained the same during the past year. Eighteen additional engineers and inspectors have been engaged during the year. Other changes and promotions in the engineering force are described in the report of the chief engineer, appended.

By the interpretation placed upon chapter 65 of the Acts of 1905 by the Attorney-General, the responsibility of operating the draw of the Craigie temporary bridge devolved upon the Commission. This advice came within a very few days of the time for opening the new draw; but fortunately a majority of the drawtenders who had gained experience in handling the draw of the old Craigie bridge were willing to enter the service of the Commonwealth. Four additional men were employed

to complete three shifts of eight hours each. Under the direction of the chief drawtender, Alfred W. Smith, the draw has been successfully operated.

(*b*) *Offices and Buildings.*

The office of the Charles River Basin Commission is located on the sixth floor of the Standish building, No. 367 Boylston Street. The field office of the Commission is located at No. 12 Bridge Street, East Cambridge, near the Cambridge end of Craigie bridge. The Commission also has a storehouse and work shed located at the foot of Leverett Street, near the Boston end of Craigie bridge.

II. The Dam and Lock — Construction.

The contract for the dam and lock (Contract No. 1) was awarded to the lowest bidder who qualified, — Holbrook, Cabot & Rollins Corporation of Boston, — and was signed Jan. 14, 1905. There were eleven bids, ranging from $1,129,530 to $761,900, these figures being based upon quantities as estimated by the Commission's engineers. Work upon this contract was begun March 1, 1905, and has proceeded satisfactorily.

(*a*) *The Coffer-dam on the Boston Side of the River.*

The larger coffer-dam, covering an area of 3½ acres of the river bottom, was nearly completed by Sept. 29, 1905. On that day the closing gap of the entire structure was made at the southwest angle. This coffer-dam is to enclose the work upon the lock and the outlet gates for the Boston marginal conduit. Some of the piles for the foundation of the lock have already been driven, and considerable dredging has been done within the area to be covered by the lock.

Details of the building of the coffer-dam on the Boston side, which is one of the largest structures of its kind ever erected in tide water, may be found in the appended report of the chief engineer.

(*b*) *The Coffer-dam on the Cambridge Side of the River.*

Work upon the smaller coffer-dam, which is to enclose nine sluices, of which the middle and largest one is to serve the

additional purpose of a lock for small boats, was begun even before the completion of the coffer-dam on the Boston side, and the contractor is making good progress.

III. Craigie Temporary Bridge.

By chapter 65 of the Acts of the year 1905, the Commission was authorized to provide a temporary highway bridge to take the place of old Craigie bridge, upon the site of which the dam is to be constructed. The Commission carried out the plan, stated in its second report, of utilizing the abandoned Boston & Maine Railroad bridge as a temporary highway bridge, by reconstructing a part of the same and by building highway approaches thereto, connecting Bridge Street in Cambridge and Leverett Street in Boston. These extensions were built over the land of the Boston & Maine Railroad, without any expense to the Commonwealth for the use thereof. Work was completed upon the bridge July 5, 1905.

The Acting Secretary of War, in his approval of the plan for the temporary bridge, dated Sept. 1, 1904, required the Commission to maintain a guide pier westerly of the temporary bridge until such time as the Boston & Maine Railroad shall be authorized to construct and maintain the pier. As shown by the accompanying photograph, the Commission's temporary bridge is so located that the railroad cannot construct such pier at this time, but the pier of the temporary bridge serves the same purpose for the time being.

IV. The Marginal Conduits.

(*a*) *The Boston Marginal Conduit — Construction.*

Contract No. 3, for Section 2 of the Boston marginal conduit (Section 1 of the conduit being included in the contract for the dam and lock), was let June 13, 1905, to James Driscoll & Son of Brookline, the lowest bidder, the total bid, according to estimated quantities, amounting to $50,600. There were ten bids. Work was begun almost immediately, and is now nearing successful completion. Under this contract 1,805 linear feet of horseshoe conduit, equivalent in interior area to a 7-foot 3-inch diameter circle, will be built in a trench

averaging 21 feet in depth below the level of the Charlesbank, at an estimated price averaging about $26 per linear foot, exclusive of engineering and supervision.

(*b*) *The Cambridge Marginal Conduit.*

Throughout the year studies have been made in relation to the Cambridge marginal conduit, but as an important part of that work is affected by the dredging to be done in the Lechmere Canal, no contract has thus far been prepared.

V. Dredging and Pile-driving in the Basin and in Broad and Lechmere Canals.

The Commission is required, by section 4 of chapter 465 of the Acts of 1903, to dredge navigable channels in the basin and in the Broad and Lechmere canals, and to strengthen the walls and wharves thereon by the driving of prime oak piles, 2 feet on centers. Work upon the specifications for the contract for the pile-driving was nearing completion on Sept. 30, 1905.

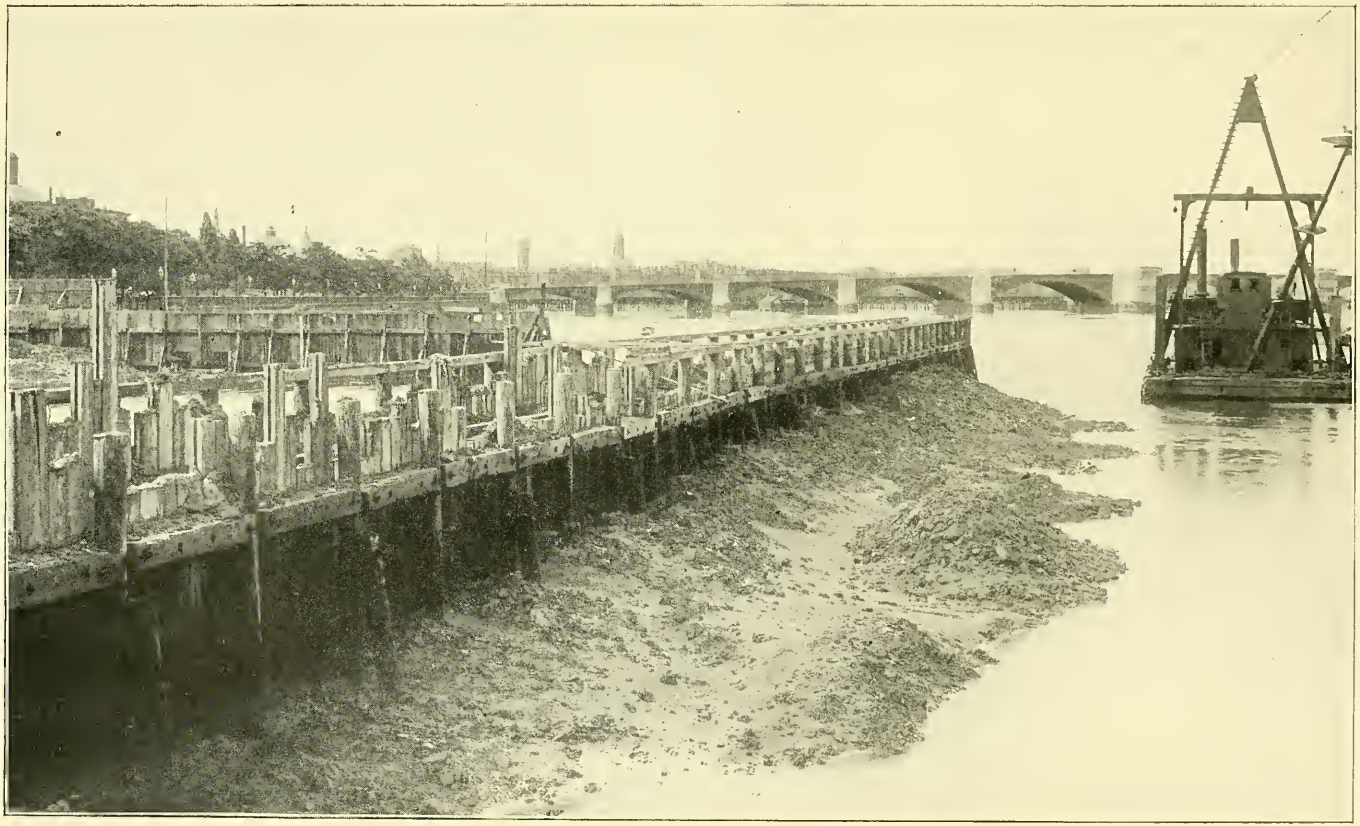
VI. Approval by the War Department of the Commission's Plans.

Section 2 of the act establishing the Commission provides that "The commission, whenever the Commonwealth has been authorized by the United States to build a dam and lock under the provisions of this act, shall proceed to do the work herein required of it, and shall in the meantime make examinations and plans therefor."

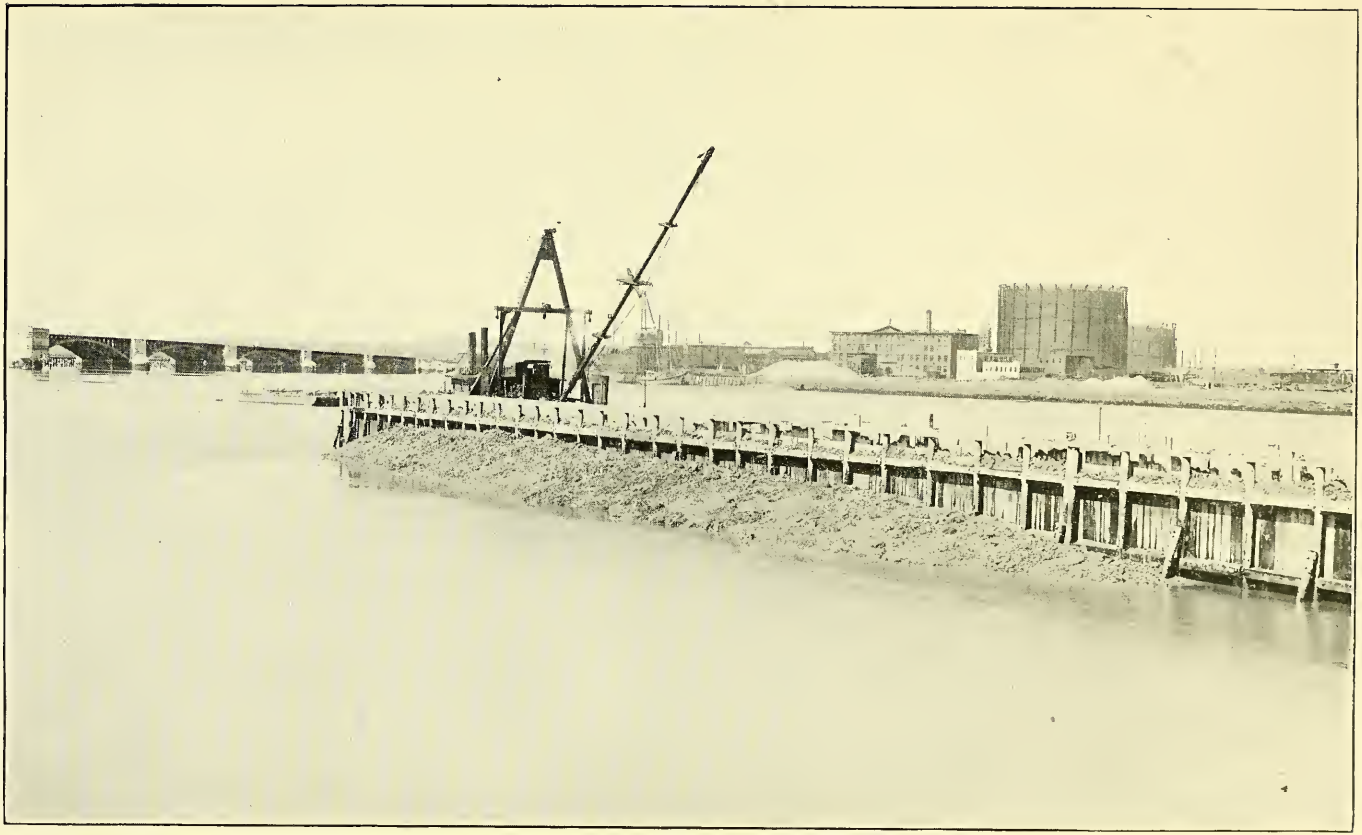
The final plans requiring the approval of the Secretary of War, as above provided, were submitted during the previous year, and approval was given on Oct. 5, 1904.

VII. Legislation of 1905.

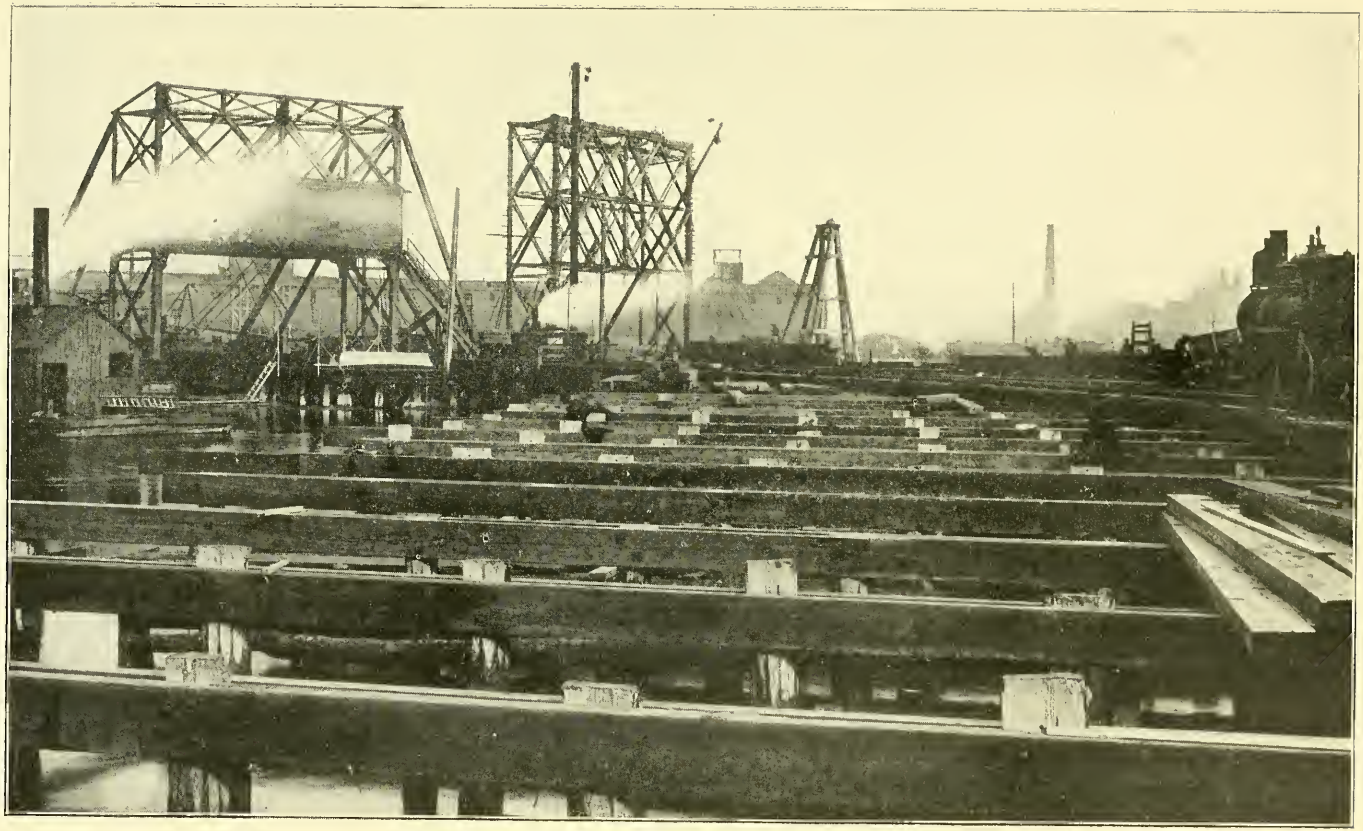
The Attorney-General having expressed a doubt as to the authority of the Commission to construct a temporary highway bridge to divert the traffic from Craigie bridge during the construction of the dam, the Commission, in its second report, recommended an amendment to chapter 465 of the Acts of



DAM AND LOCK — Outside Embankment of Coffer-dam at Lock.



DAM AND LOCK — Inside Embankment of Coffer-dam at Lock.



TEMPORARY BRIDGE — New Portion at Boston End.

1903, which the Legislature passed, the amendment being chapter 65 of the Acts of 1905, which will be found printed as a part of the act, in Appendix A.

VIII. Additional Legislation needed.

(*a*) *Supply of Reports inadequate.*

Requests for the reports of the Commission have vastly exceeded the supply. The Commission is given for distribution only 350 copies, and it has been found that many important offices in the cities and towns affected by the improvements being carried on by the Commission are without its reports. The Commission therefore recommends that it be authorized to print an edition of 3,000 of this and future reports, also to reprint editions of 1,000 copies each of the first and second reports.

(*b*) *Machinery of Drawbridges under Same Control as Machinery of Lock.*

The studies of the engineers upon plans for the machinery to operate the lock gates and the drawbridges over the lock indicate the desirability of having the machinery of both the drawbridges and the lock under control of the same Board. This arrangement will be in the interest of economy, and will better provide for the safety and convenience of the public using the highway and of vessels passing through the lock. Chapter 465 of the Acts of 1903 gives to the Metropolitan Park Commission the control of the lock, and to the Commissioners of Cambridge Bridges the control of that portion of the dam which serves as a bridge. The Commission recommends that chapter 465 of the Acts of 1903 be amended to give authority over the operation of the drawbridges and over the operation of the lock to the same commission.

IX. Takings of Property.

Certain buildings on piles near the Boston end of Craigie bridge and attached thereto, and the land beneath the same, covered by tide water, claimed by the heirs of Caroline M. McGlenen, were taken Feb. 18, 1905.

The property of George O. Proctor, next adjoining the Cambridge end of Craigie bridge, and necessary for an approach to the dam, was taken June 26, 1905.

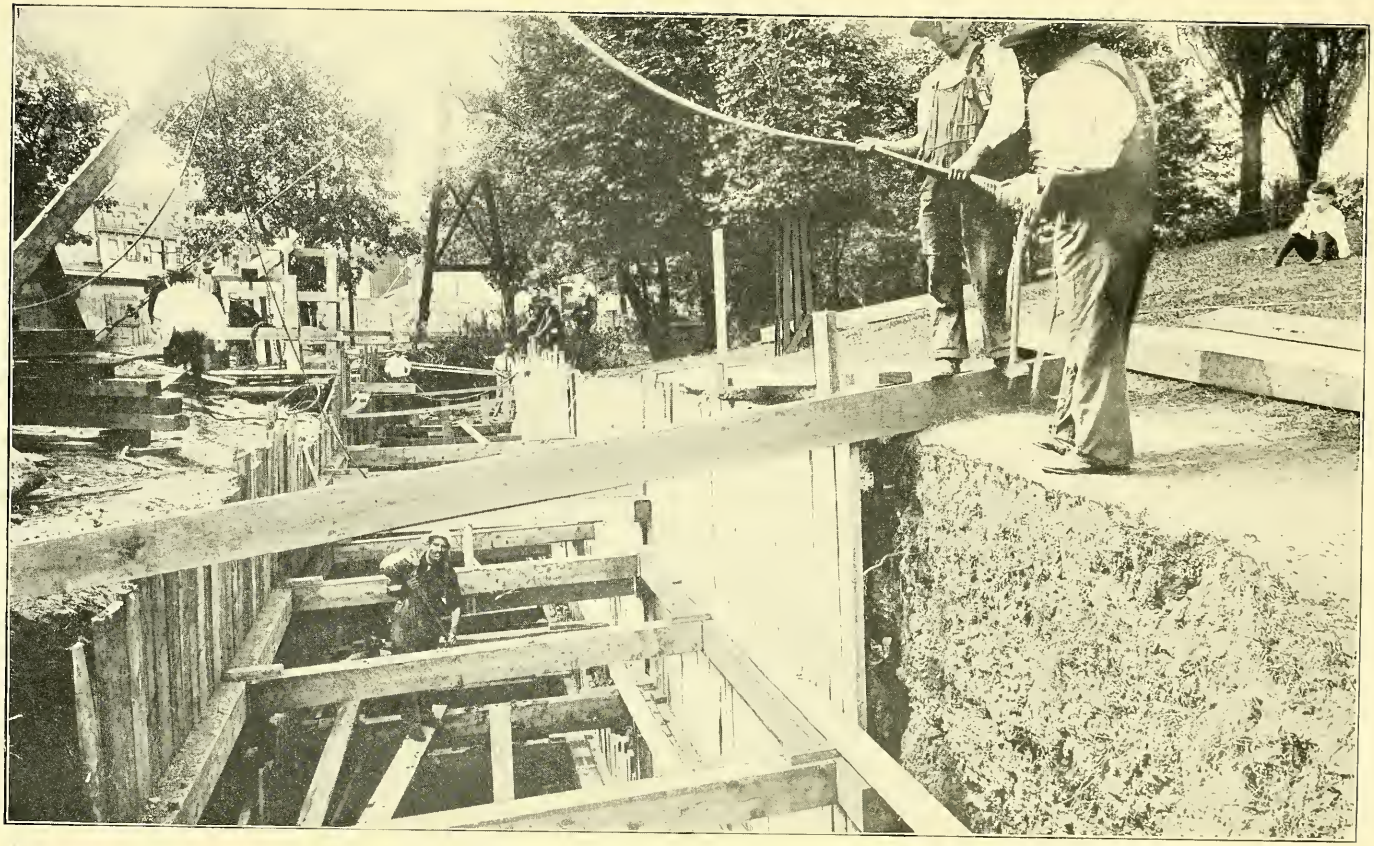
X. Contracts awarded.

Besides the larger contracts, — No. 1 for the dam and lock and No. 3 for a section of the Boston marginal conduit, — seventeen smaller contracts were awarded during the year. Upon all of these, except upon Contract No. 2, with the United States Wood Preserving Company for paving, satisfactory work has been done.

The following is a complete list of contracts let prior to Oct. 1, 1905: —

No.	Name.	Work.	Amount.	Date.
1	Holbrook, Cabot & Rollins Corporation.	Dam and lock in the Charles River.	$801,607 50	Jan. 14, 1905.
2	United States Wood Preserving Company.	Wooden block paving for temporary bridge.	11,700 00	Mar. 23, 1905.
3	James Driscoll & Son, . .	Section 2 of the Boston marginal conduit.	50,600 00	June 13, 1905.
4	Camden Iron Works, . .	Cast-iron pipes and special castings.	5,640 75	July 18, 1905.
5	Henry R. Worthington, .	Furnishing and erecting pumps.	9,533 00	Sept. 30, 1905.
6	Gibby Foundry Company, .	Castings and other metal, .	6,013 74	July 27, 1905.
7	Geo. McQuesten Company, .	Yellow pine lumber for temporary bridge.	12,476 58	Feb. 14, 1905.
8	Rockport Granite Company,	Granite paving blocks for temporary bridge.	1,927 10	Mar. 22, 1905.
9	New England Granite Company.	Granite edgestones for temporary bridge.	525 00	Mar. 22, 1905.
10	General Electric Company, .	Motors for draw in temporary bridge.	812 50	Mar. 22, 1905.
11	E. D. Sawyer Lumber Company.	Spruce lumber for temporary bridge.	4,495 43	Mar. 23, 1905.
12	Harrington, Robinson & Co.,	Tees for wheel-guard on temporary bridge.	817 08	Mar. 29, 1905.
13	Aberthaw Construction Company.	Twisted steel rods for reenforcing concrete.	5,219 20	May 29, 1905.
14	Gibby Foundry Company, .	Castings for overflow, Boston marginal conduit.	736 80	July 22, 1905.
15	Coffin Valve Company, .	Composition at dam and lock.	1,773 44	July 31, 1905.
16	The Boston Bridge Works, .	Brackets for lock gate bearings at lock.	1,301 30	Aug. 2, 1905.
17	The Lumsden & Van Stone Company.	Welded pipe for electric conduits under lock.	3,972 75	Aug. 18, 1905.
18	The Ludlow Valve Manufacturing Company.	Gate valves at lock, . .	861 95	Aug. 25, 1905.
19	The Scherzer Rolling Lift Bridge Company.	Plans, specifications, engineering and patent rights for superstructure, operating machinery, etc., for drawbridge over lock.	4,500 00	Aug. 25, 1905.

A more detailed account of these contracts may be found in the chief engineer's report, appended.



BOSTON MARGINAL CONDUIT — Excavation in Sheeted Trench.

On the above contracts the following amounts were reserved on monthly estimates, and are not due until the completion of the contracts, or until final settlement: —

Name.	Work.	Amount.
Holbrook, Cabot & Rollins Corporation.	Dam and lock, ...	$17,987 67
United States Wood Preserving Company.	Wooden block paving for temporary bridge.	843 98
James Driscoll & Son, ...	Section 2 of the Boston marginal conduit.	2,289 25
		$21,120 90

XI. Hearings.

During the year the Commission gave the following hearings: to the representatives of the wharf owners on the Broad and Lechmere canals and on Charles River basin, represented by Mr. William A. Hunnewell, Mr. Albert M. Barnes and Mr. J. Frank Wellington, two hearings, relative to work in front of the walls and wharves in the canals and on the basin; to representatives of the barge lines and tow-boats, relative to the bringing of barges through the draw of the temporary bridge; to Mr. George G. Crocker and Mr. Frederic D. Fisk, trustees of the Main Street land trust, relative to the use of their gravel and sand in the construction of the dam; to Mr. George O. Proctor, owner of the land needed for the approach to the dam on the Cambridge side, relative to the proposed taking of his property; to the Commissioners of Cambridge Bridges and representatives of the Boston Elevated Railway Company, relative to paving to be used on the temporary bridge; to Mr. Henry Parkman, Mr. Edmund D. Codman, Mr. Henry G. Vaughan and Dr. J. Payson Clark, representing the Union Boat Club, relative to the location of their boat-house in relation to the Boston marginal conduit; to Mr. A. B. Clements and Mr. Alex. Reed, vice-presidents of the United States Wood Preserving Company, and Mr. B. T. Wheeler, their engineer, relative to remedies for defects in their paving of the temporary bridge.

XII. Issue of Bonds.

On the twenty-seventh day of December, 1904, the Commission voted to advise the Treasurer of the Commonwealth to make available additional funds to the amount of $400,000 for the year 1905. Bonds to the amount above named were issued under the title of the Charles River basin loan, and sold by the Treasurer. The total issue of bonds on account of the Charles River basin loan, to Oct. 1, 1905, is $650,000.

XIII. Payments to the Sinking Fund.

Payments to the sinking fund of the Charles River basin loan during the year have amounted to $27,384.26. The total payments to the sinking fund, to Oct. 1, 1905, amounted to $38,691.80.

XIV. Miscellaneous.

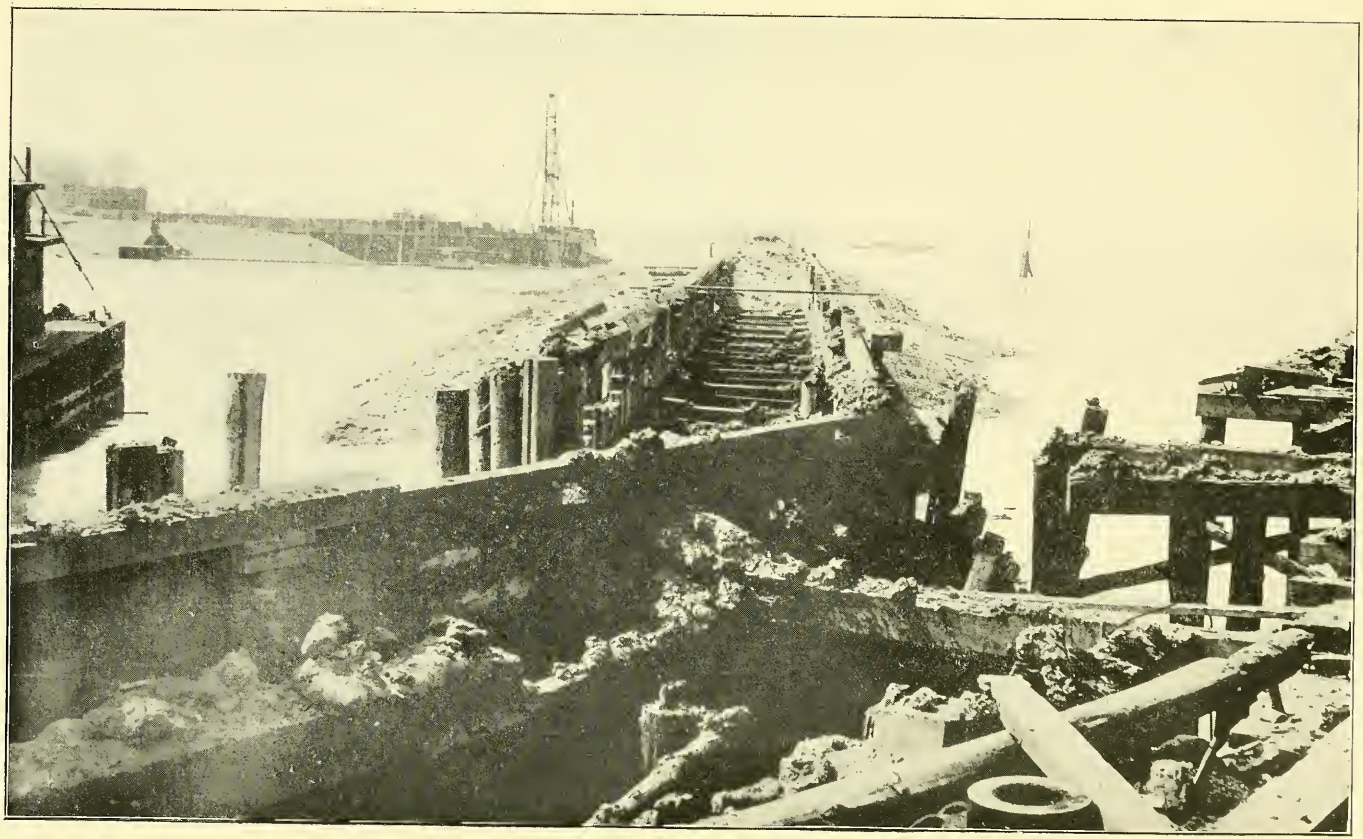
Fifteen hundred copies of the second annual report of the Commission were printed, of which 100 copies were bound in cloth, at a total cost of $454.27.

XV. Statement of Expenditures.

The total amount of expenditures for the year beginning Oct. 1, 1904, and ending Sept. 30, 1905, is $212,684.67. The total amount from July 29, 1903, the date of the organization of the Commission, to Sept. 30, 1905, is $263,072.14.

The general character of these expenditures is as follows: —

	For the Year ending Sept. 30, 1905.		From Beginning of Work to Sept. 30, 1905.	
Administration.				
Commissioners,	$10,000 00		$21,358 02	
Secretary,	2,147 22		2,383 33	
Clerks and stenographers,	658 84		1,136 84	
Traveling,	76 49		208 19	
Stationery and printing,	914 97		1,167 90	
Postage, express and telegrams,	44 74		52 96	
Furniture and fixtures,	53 86		312 11	
Alterations and repairs of building,	–		123 10	
Telephone and lighting,	79 71		140 41	
Rent,	285 72		720 24	
Miscellaneous expenses,	41 52		92 52	
		$14,303 07		$27,695 62
Amounts carried forward,		$14,303 07		$27,695 62



DAM AND LOCK — Westerly Side of Coffer-dam at Lock.

	For the Year ending Sept. 30, 1905.		From Beginning of Work to Sept. 30, 1905.	
Amounts brought forward, . . .	. . .	$14,303 07		$27,695 62
Engineering.				
Chief, principal assistant and division engineers,	$10,725 00		$20,594 24	
Engineering assistants,	16,481 90		26,975 99	
Consulting engineers,	2,400 90		5,300 90	
Inspectors,	3,118 46		3,118 46	
Architect,	–		582 00	
Traveling,	173 69		363 55	
Wagon hire,	8 50		58 50	
Stationery and printing,	975 10		1,654 67	
Postage, express and telegrams,	39 81		80 09	
Instruments and tools,	639 05		2,731 86	
Engineering and drafting supplies,	235 79		532 72	
Books, maps and photographs,	414 45		614 48	
Furniture and fixtures,	515 08		1,888 99	
Alterations and repairs of building: —				
Main office,	–		1,092 14	
Sub-office,	214 06		214 06	
Telephone and lighting, — main office,	178 87		377 88	
Telephone, lighting, heating and care of building, — sub-office,	139 12		194 88	
Rent, — main office,	1,714 32		3,446 47	
Rent of field office,	146 45		251 45	
Unclassified supplies,	52 40		65 94	
Miscellaneous expenses,	71 69		95 03	
		38,244 64		70,234 30
Construction — Preliminary.				
Labor,	$854 83		$5,000 94	
Traveling,	92		19 08	
Water rates,	–		3 45	
Freight and express,	50 25		51 17	
Jobbing and repairing,	1 04		35 68	
Tools, machinery, appliances and hardware supplies,	75 34		185 76	
Castings, ironwork and metals,	120 58		201 54	
Iron pipe and valves,	19 81		98 96	
Fuel, oil and waste,	16 80		62 65	
Lumber,	229 54		338 08	
Cement,	–		24 75	
Sand,	–		3 00	
Unclassified supplies,	10 99		14 69	
Miscellaneous expenses,	10 23		355 84	
		1,390 33		6,395 59
Construction — Contracts.				
Contract No. 1, Holbrook, Cabot & Rollins Corporation,	$101,930 12		$101,930 12	
Contract No. 2, United States Wood Preserving Co.,	4,782 52		4,782 52	
Contract No. 3, James Driscoll & Son,	12,972 44		12,972 44	
Contract No. 7, Geo. McQuesten Co.,	12,476 58		12,476 58	
Contract No. 8, Rockport Granite Co.,	1,927 10		1,927 10	
Contract No. 9, New England Granite Co.,	525 00		525 00	
Contract No. 10, General Electric Co.,	812 50		812 50	
Contract No. 11, E. D. Sawyer Lumber Co.,	4,495 43		4,495 43	
Contract No. 12, Harrington, Robinson & Co.,	817 08		817 08	
Contract No. 13, Aberthaw Construction Co.,	4,614 80		4,614 80	
Contract No. 15, Coffin Valve Co.,	2 35		2 35	
		145,355 92		145,355 92
Construction — Additional.				
Labor,	$4,394 74		$4,394 74	
Traveling,	86		86	
Freight and express,	4 30		4 30	
Jobbing and repairing,	172 97		172 97	
Tools, machinery, appliances and hardware supplies,	4,695 66		4,695 66	
Castings, ironwork and metals,	196 33		196 33	
Iron pipe,	6 91		6 91	
Paint,	7 00		7 00	
Fuel, oil and waste,	38 53		38 53	
Lumber,	3,088 91		3,088 91	
Stone,	4 00		4 00	
Amounts carried forward, . . .	$12,610 21	$199,293 96	$12,610 21	$249,681 43

	For the Year ending Sept. 30, 1905.		From Beginning of Work to Sept. 30, 1905.	
Amounts brought forward,	$12,610 21	$199,293 96	$12,610 21	$249,681 43
Construction — Additional — Con.				
Sand,	4 00		4 00	
Corporation work,	266 97		266 97	
Unclassified supplies,	188 96		188 96	
Miscellaneous expenses,	160 88		160 88	
		13,231 02		13,231 02
Real Estate.				
Legal and expert,	$159 69		$159 69	
		159 69		159 69
Totals,		$212,684 67		$263,072 14

The foregoing expenditures have been distributed among the various objects or works as follows: —

	For the Year ending Sept. 30, 1905.	From Beginning of Work to Sept. 30, 1905.
Administration, applicable to all parts of the work,	$14,303 07	$27,695 62
Dam,	23,598 19	38,881 31
Lock,	61,160 29	69,395 21
Temporary bridge and approaches,	76,884 81	77,869 65
Drawbridge,	8,143 00	8,859 56
Highway,	–	60 92
Dredging in basin,	153 62	674 91
Broad Canal,	1,006 39	2,961 12
Lechmere Canal,	628 28	1,537 90
Boston marginal conduit,	26,619 17	34,206 19
Cambridge marginal conduit,	187 85	929 75
Totals,	$212,684 67	$263,072 14

The report of the chief engineer follows.

In Appendix A will be found, indexed, chapter 465 of the Acts of 1903, as amended by chapter 65 of the Acts of 1905.

In general, the Commission desires to report a successful year of work and progress, at as rapid a rate as it had anticipated. The Commission desires at the same time to express its indebtedness to the secretary and to the efficient engineering staff for the results achieved.

Respectfully submitted,

HENRY S. PRITCHETT,
HENRY D. YERXA,
JOSHUA B. HOLDEN,
Charles River Basin Commission.

Boston, Jan. 4, 1906.

REPORT OF THE CHIEF ENGINEER.

To the Charles River Basin Commission.

GENTLEMEN : — The following is a report of the work of the engineering department for the year ending Sept. 30, 1905.

ORGANIZATION.

Mr. Frank E. Winsor continued as division engineer until May 21, 1905, when he was promoted to the position of principal assistant engineer. His duties consisted mainly of designing, drafting and other office work, although he occasionally supervised some of the field work.

Mr. John L. Howard continued as division engineer, in charge of field work.

Mr. Frederic P. Stearns continued to act as consulting engineer.

Mr. Guy Lowell was consulted in architecture and landscape architecture.

Mr. J. R. Worcester was consulted in regard to designs for lock gates and appurtenances, and other problems connected with structural steel work.

The engineering force at the beginning of the year numbered 18, and was increased from time to time as the work required, until at the end of the year it numbered 35.

The names of the assistants in the engineering department, not mentioned above, who have been employed for not less than one month, are given below, with the positions last held, together with an indication of the work performed by them : —

Assistant Engineers.

John N. Ferguson,	Hydraulic studies, estimates and miscellaneous office work, until June 15, 1905; subsequently, field work.
Edward C. Sherman,	Designs and studies for steel work and masonry.
J. Albert Holmes,	Field work.
Leonard P. Wood,	Hydraulic studies and designs for masonry.
William C. Pickersgill,	Designs and studies for masonry, tests of yellow pine timber, and miscellaneous office work.

Inspectors.

Daniel A. Story,	Inspector of piling and bridge work.
Arthur I. Plaisted,	Engineering inspector.
Franklin L. Mason,	Inspector of masonry.
Daniel J. Sullivan,	Inspector of piling, bridge work and paving.
Walter N. Charles,	Engineering inspector.
George L. Bosworth,	Assistant inspector.

Draftsmen, Instrumentmen, etc.

Walton H. Sears,	Mechanical assistant.
Walter R. Kattelle,	Draftsman.
Jennie L. Rawson,	Clerk and stenographer, — administrative work, accounts and letters.
Herbert W. Olmsted,	Instrumentman.
Morton F. Sanborn,	Instrumentman.
Frederic C. H. Eichorn,	Instrumentman.
Robert E. Barrett,	Instrumentman.
Walter E. Wheeler,	Instrumentman.
Norman C. McNeil,	Instrumentman.
John M. O'Donoghue,	Instrumentman.
Ethelyn B. Marlatte,	Clerk and stenographer.
Albert J. Holmes,	Draftsman.
James E. Barlow,	Rodman.
Bertram I. Hall,	Rodman.
Thomas J. Long,	Rodman.
Frank V. Andrews,	Rodman.
Edith F. White,	Stenographer.
Frank A. McDonald,	Rodman.
Edward L. Lincoln,	Rodman.
Alfred Wm. Treen,	Clerk and messenger.

Mr. Arthur W. Tidd, who was employed as assistant engineer during the greater portion of the previous year, resigned on Oct. 15, 1904, to accept a position as assistant engineer with the Aqueduct Commission of the city of New York.

In addition to the above regular employees, Mr. Herbert L. Sherman, having a chemical and cement-testing office at 220 Devonshire Street, Boston, had charge of cement testing; and Mr. William R. Conard of Burlington, N. J., had charge of inspection of pipes manufactured at Camden, N. J., under a contract with the Camden Iron Works.

The principal engineering office was continued at 367 Boylston Street, Boston, and the office for the field force was continued at 12 Bridge Street, East Cambridge. This field office was enlarged during the latter part of March by the occupancy of the entire space of the first and second floors. On the second floor a partition was removed and three additional windows put in, making a drafting room, 24 feet by 16 feet, well lighted.

Dam and Lock.

This important portion of the work to be done by the Commission occupied the engineering staff, both in the office and in the field, for the larger proportion of the year. A general description of this, together with the construction work thereon, is submitted herewith.

The contract plans were well advanced at the end of the previous year, and the specifications and plans were completed in time to advertise for bids early in November, bids being opened on Dec. 20, 1904. These plans were of necessity somewhat general in character, and details were left for future consideration. These details very largely occupied the attention of the office force during the year.

Working drawings were in progress during the year, of masonry, pile plans, steel reenforcement of concrete, and miscellaneous details.

It having been decided to make a taking of the entire property in Cambridge between Lechmere Canal and Bridge Street, extending from the river to Commercial Avenue, and also to fill between the rest pier at the up-stream end of the lock and

the Boston side of the river, a new plan, approved by the consulting landscape architect, was made, a copy of which (Plan No. 2) is submitted herewith.

Approval of the War Department.

The final plans requiring the approval of the Secretary of War, submitted during the previous year, were approved on Oct. 5, 1904, thereby removing the last obstacle in the way of actual construction.

Coffer-dam at the Boston Side of the River.

The contract for the dam and lock provides that the contractor may use the design of coffer-dams submitted with the contract plans, or such other design of his own as the engineer may approve.

Various designs for the coffer-dam on the Boston side were considered by the contractor, and a detailed study was given to the merits of the various suggestions. A final type of dam was submitted by the contractor and approved by the engineer, which differed mainly from the original design, in that the two rows of sheeting called for were spaced 8 feet instead of 30 feet apart, and additional earth filling was required in order to give substantially the same stability as the original design. As built, the coffer-dam consists of two rows of 6-inch yellow pine sheeting, "square edge" classification, 8 feet apart in the clear, with 1½-inch by 3-inch spruce splines. Round guide piles of spruce or Norway pine, 12 inches in diameter at the butt, were driven 10 feet on centers, with one spurshore pile at each bent, first on one side and then on the other. There are two lines of lower wale timbers, consisting of 6-inch by 10-inch yellow pine, with centers at elevation 102.5, and between the round piles at the same elevation were fitted 10-inch by 10-inch yellow pine sticks. These were bolted to each other with three ¾-inch bolts, and at each end of the 10-inch by 10-inch sticks are 1¼-inch diameter tie rods, some 12 feet long, extending between each line of sheeting, wales, etc. The centers of the upper wales, also 6-inch by 10-inch yellow pine, are at elevation 110.5, and between the round piles at this elevation are 6-inch

by 12-inch, or larger, yellow pine filling pieces. These were bolted through with two ¾-inch bolts, and through each end of the filling pieces were bolted 1¼-inch tie rods, some 12 feet long. Between the two lines of sheeting at both the top and bottom wales, opposite the round piles, were placed 8-inch by 10-inch yellow pine braces, strengthened by 3-inch by 10-inch spruce cross-bracing spiked to the large braces. The filling between the two rows of vertical sheeting is largely of a fine, silty sand, mixed in places with clay and gravel from the channels in the lower harbor. The earth filling on the river side of the coffer-dam is mainly of clay and gravel, and approximates a 2 to 1 slope, with the top at elevation 105. The top of the embankment on the lock side is at elevation 110, with a width of 25 feet and a side slope of 2 to 1. For a depth of 4 feet on top and some 10 feet on the slope the embankment consists of sand and gravel, to allow the embankment to drain freely when the coffer-dam should be pumped out. The portion next the sheeting is made of more impervious material. Where the ends of the coffer-dam come in contact with the Charlesbank wall, a trench was made through the wall after the stones had been entirely removed, and the two lines of sheeting were brought together a short distance inside of the wall. For boring the holes required for the bolts and tie rods in the coffer-dam, the contractor fitted up a small scow with an air-compressor plant, and most of the holes were bored by the aid of compressed air.

Early in the spring the drawtenders' house and other buildings on the down-stream side of the bridge were removed. In June piles were driven at the southerly end of the coffer-dam, to support the sluices.

In order to permit the water to rise and fall with the tide inside the coffer-dam when the closure in the sheeting was being made, the contract provided that the sluices in this coffer-dam should have an area of not less than 36 square feet, and that the middle of the sluices should not be above elevation 102.5. As built, there were two openings, each 5 feet 6 inches high, the larger opening being 5 feet wide and the smaller one 2 feet 6 inches wide. These extended through the embankment in the dam in one flume about 40 feet long, 5 feet 6

inches high, and tapering from a width of 14 feet at one end to a width of 10 feet at the other end. The gates for the sluices were built of 6-inch splined yellow pine timber, and were fitted with a rack and pinion for hand operation.

At 7 A.M. on July 5, the temporary bridge having been completed, the work of tearing down the old draw and other portions of the bridge which interfered with the construction of the coffer-dam was begun; and by the end of the week all of the draw had been removed, and the piling for the coffer-dam was being driven where the bridge had been removed.

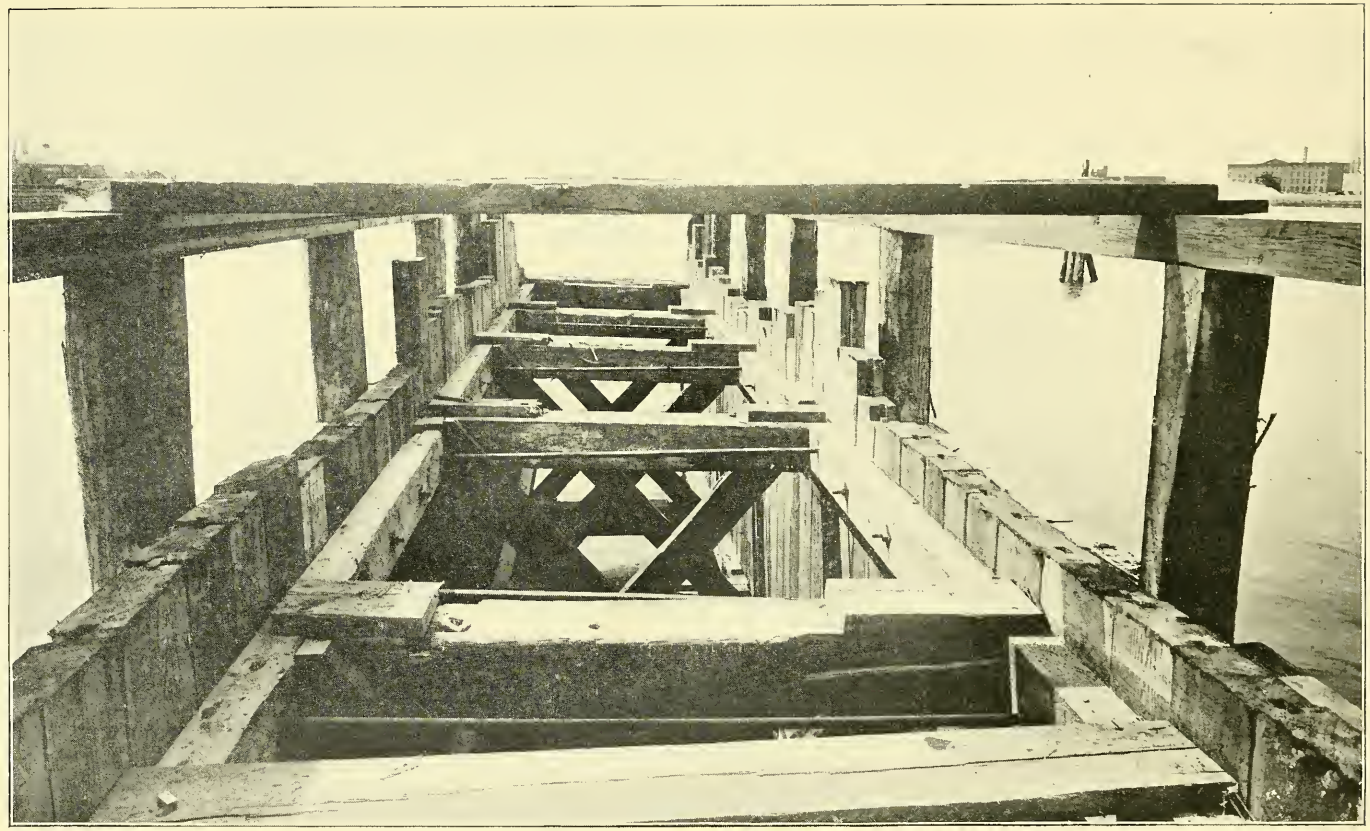
In order to protect the lower end of the coffer-dam from being damaged by vessels passing through the draw of the temporary bridge, a fender was built some 15 feet below the lower line of sheeting, consisting of piles 8 feet on centers, with a spurshore to each pile and double spurshores on alternate piles, and with three lines of double girder caps, — one at mean tide, one at mean high water and the other at about elevation 115. On top of the top row was placed an 8-inch by 16-inch rider cap.

On September 29 the closing gap in the entire structure was made at the southwest angle.

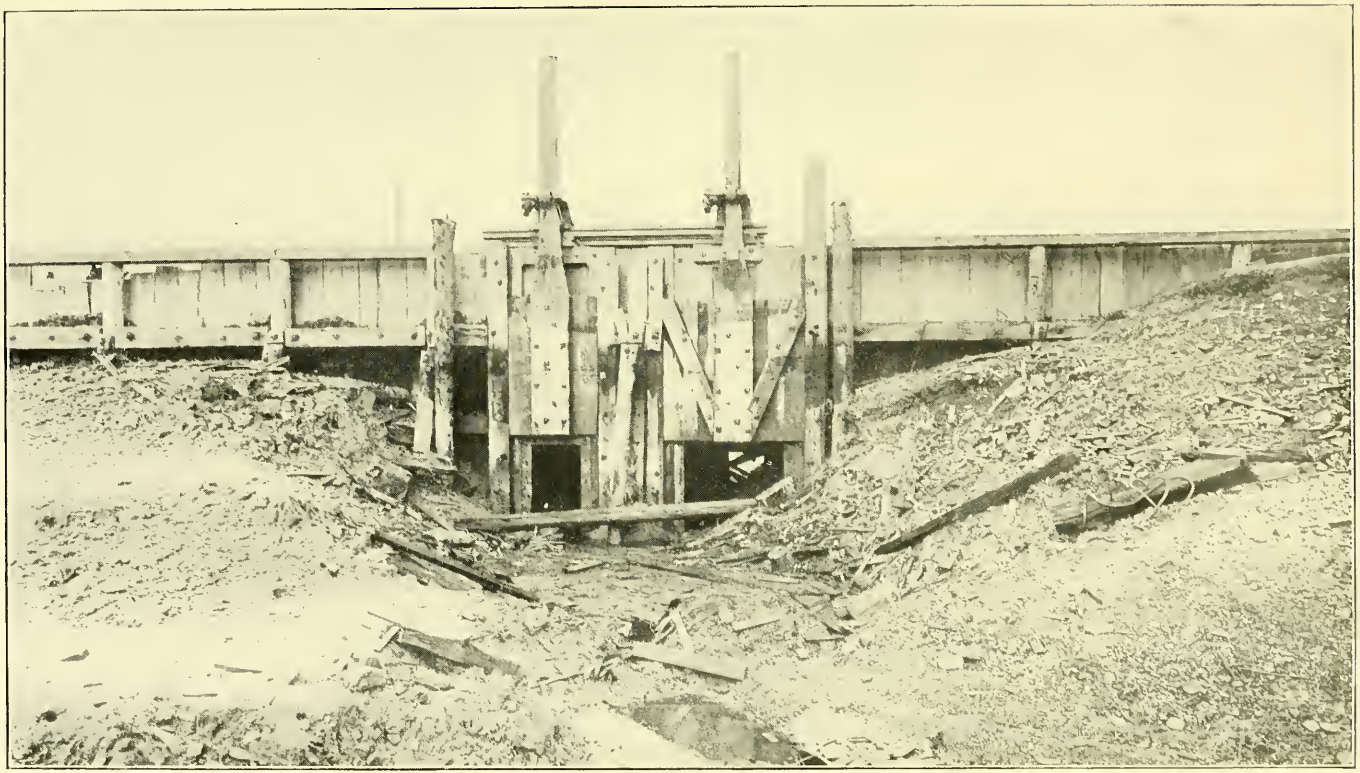
In the construction of this coffer-dam 437 round piles, 746 M. feet B. M. of yellow pine lumber, 606 scow loads and 4,617 cart loads of earth were used. The earth delivered by scows came from the excavations for the lock, from the river above the Cambridge bridge and from the dredging in the harbor. The earth delivered by carts came from the excavations for the Boston marginal conduit and for the subway under construction by the Boston Transit Commission, and from other sources.

Excavation for the Lock.

The excavation for the foundation of the lock was started April 27. The surface material, being considered unsatisfactory for use in the coffer-dam, was deposited within the cross-section of the dam, as near the Cambridge shore as it could be placed without interfering with the construction of the sluices. The remainder of the material excavated at the lock was used in the construction of the coffer-dam.



DAM AND LOCK — Bracing in Coffer-dam for Lock.



DAM AND LOCK — Sluices in Coffer-dam at Lock.

Foundations of the Lock.

At the request of the contractor, permission was given, before the lock was pumped out, to drive some 500 piles at the lower 40 feet of the lock, where the masonry projected into the inside slope of the coffer-dam; with the understanding that if, after the coffer-dam was pumped out, any piles were found to be out of place or improperly driven, the contractor would drive other piles in the proper places without expense to the Commission.

Lock Gates.

The question of final design of lock gates was taken up about the middle of the year, and the various conditions to which these gates might be exposed in extreme cases were considered in making the design. It was thought desirable to provide for the possibility of the lock being used as a flood sluice during extraordinary upland floods. This necessitates that both gates be open at the same time, the last one being opened on a falling tide, when the tide and basin are at the same level. The gates have been so designed that in case this use should be attempted unsuccessfully, through failure to get the gate open more than part way before the falling tide causes sufficient pressure on the up-stream side of the gate to prevent the completion of the operation, the consequent pressure due to the head of water on the basin side of the gate would do it no injury. This necessitates very heavy construction for the top girders and for the bearings for the lock gates.

The lower lock gate has been designed in detail. The bearings and other metal work connected with the gates have also been decided upon. The filling gates, also, which are to be a part of the lock gate structures, were considered in detail. The designs for the operating mechanism, which will consist of chains running over sprocket wheels and driven by electric motors, had been carried nearly to completion at the end of the year.

Stop-planks at Lock.

The lock has been so designed that, if necessary, stop-planks can be placed at either end of the lock, and the lock pumped out. The design of these stop-planks, which are required to

span an opening 45 feet in width, with a maximum depth on the down-stream side of about 32 feet and on the up-stream side of 21 feet, involved considerable study. At the end of the year details had been completed, which consist of trusses spanning the lock near the top and supporting two vertical steel girders, which divide the width of the lock into three spaces, with provision for stop-planks to span these spaces. These stop-planks are of wood, reenforced with a sufficient amount of metal to give them the required strength and to insure their sinking in the water.

Metal at Lock.

Detail plans of a considerable part of the metal at the lock were made, and the work contracted for in the latter part of the year. These plans included steel for reenforcing concrete; adjustable bearings for the lock gates, capable of taking the maximum pressures due to extreme conditions on the gates; manhole frames and covers; anchorages for holding lock gate bearing timbers in place in the masonry; steel brackets for supporting rear lock gate bearings; bed plates for operating machinery; cast-iron pipe for suction and discharge from pump-wells, for conduit under lock and for gage pipes; and lap-welded pipes for electric ducts under the lock.

The question of specifications for steel rods for reenforcing the masonry was given detailed study; and a schedule for steel which it was estimated might possibly be required during the season of 1905 was prepared, and a contract let on May 29 for these rods.

Heating Plant.

The legislative act establishing the Commission requires the lock to be operated throughout the year, and much study was made of various methods for keeping the lock gates free from ice. Tentative designs were made of a boiler plant in the lower lock gate-house, of sufficient size to heat both lock gates in such manner as to permit their operation in the coldest weather, to heat the superstructures at the two lock gates, and to provide sufficient heat at the sluices to warm the gate-chambers and to insure the sluice gates from freezing.

In connection with the design for heating, it was considered desirable to get more positive data than existed in any available technical literature, from which to draw conclusions as to the size of plant required and the best method of manipulation. The problem appeared to be a novel one, and as very little satisfactory information could be obtained in reference to it, it was decided to make some experiments, to determine, if possible, some of the doubtful factors. These experiments may be briefly described as follows : —

The experiments were made at the upper Mystic Lake. The old gate-house of the Boston water works, located on the Medford shore near the dam, made a satisfactory boiler house and a place to store instruments and tools. This house was kindly placed at the disposal of the Commission by the Metropolitan Water and Sewerage Board.

The experimental apparatus consisted of a 5 horse-power vertical tubular boiler and two concentric steel tanks 5 feet high, the outer tank being 4 feet in diameter and the inner tank 3 feet in diameter, bolted together at the bottom, thus leaving a 6-inch annular space between the tanks, in which were placed two double-turn coils of 1-inch pipe, each entering from and returning to the interior of the inner tank, and so arranged that steam could be supplied to either or both. In addition to these coils, there was at the bottom of the annular space a third coil, of ¾-inch pipe perforated with 1/16-inch diameter holes pitched about 2 inches. Steam could also be supplied to this coil. The tanks were suspended by chain falls from an overhead framework built upon an old timber structure in the pond near the gate-house. The tanks were so suspended that they could be raised entirely above the surface of the water, or lowered so as to be almost entirely submerged. The method of conducting the tests was as follows : —

The tanks were partially submerged and allowed to freeze in, usually over night or longer. They were then warmed by one of the following methods until free from the surrounding ice, and sufficient heat was applied to prevent the further formation of ice around them. Three methods of heating were tried : No. 1, using the radiator coils of 1-inch pipe, with air in the annular space ; No. 2, using these same coils with water in the

annular space; No. 3, using the perforated coil of ¾-inch pipe to blow steam into water in the annular space. Two operators were necessary in conducting the experiments: one to fire the boiler and make the necessary readings of thermometers, etc., which were outside of the tanks; the other to control the steam flow into the coils and to make readings of the instruments inside the tanks; the latter operator remaining in the tanks during the entire test, which usually lasted from one to three hours. The following observations were made at regular intervals: steam pressure at boiler: atmospheric temperature; temperature of the condensed steam; pressure and temperature of the steam entering the coils; and temperature of the air or water in the annular space at elevations of 4 inches, 16 inches, 28 inches, 40 inches and 52 inches above the bottom. The condensation was collected and weighed. All surfaces from which heat could be radiated uselessly were covered with asbestos or hair felt. Drip cocks were placed at proper points. In this way all but a small percentage of the heat applied to the tanks was radiated at the outer skin, and could be measured.

Thirteen tests were made in all, and the data has been analyzed and tabulated. The results were as consistent as could be expected, and were of considerable value in calculating the amount of heat which will be consumed in warming the lock gates and determining the required capacity of the boiler plant.

Timber Tests.

The various structures connected with the work at the dam and lock will require the use of a considerable amount of timber under water; and at certain points it is desirable to obtain positive information in regard to the behavior of timber under these conditions. This is particularly true of the bearings for the large lock gates. It is proposed to use timber on the bearing surfaces on each side of the lock gates; and since these gates in opening are to slide back between the timber faces into recesses, provision is necessary for sufficient clearance for moving the gates without binding, and at the same time it is desirable, for various reasons, to keep this clearance as small as is safe. Information in regard to the amount of swelling to be expected in timber to be used in water, and the

variations of timber alternately wet and dry, was desired. The possibility of using timber treated by a preservative process, which would exclude moisture and thus prevent swelling, was considered, and various preservative processes were investigated. It was found that the only preservative which is insoluble, and thus can be used to advantage on timber immersed in water, is one containing creosote. It was decided to make some experiments to determine the value of the preservative in excluding moisture, and to learn the amount of increase in dimensions of both treated and untreated timber when immersed in water. Ten pieces of long-leaf yellow pine, 4 inches by 12 inches, 6 inches by 14 inches and 12 inches by 12 inches, about 24 feet long, and four pieces of white oak, 4 inches by 12 inches, 8 inches by 8 inches and 14 inches by 14 inches, about 20 feet long, were cut in halves, and one half of each timber was treated by a creosote preservative process, while the other half was left untreated. These timbers, when well dried, were weighed and carefully measured by the aid of a micrometer caliper to .001 of an inch, after which they were put in water and weighed and measured from time to time for some three months. At the end of this time the greater part of these timbers had apparently reached the maximum of increase in weight and size. The variations in weight and dimensions of the treated timbers were found to be very slight; but since it was noted that some of the preservative appeared to be washing out, a further increase might be expected. The increase in dimensions was far greater in the untreated than in the treated timbers. For the six untreated long-leaf yellow pine sticks the increase in dimensions varied from a minimum of .04 per cent. to a maximum of 1.03 per cent., with an average of .43 per cent.; the stick giving the maximum value contained a large percentage of sap-wood, and if this stick were neglected, the maximum would become .53 per cent. and the average .31 per cent. For the four oak sticks the increase in dimensions varied from a minimum of .12 per cent. to a maximum of .33 per cent., with an average of .21 per cent. Some of the timbers have been left soaking in the tanks, so that further measurements may be made to demonstrate with greater certainty that the ultimate increase in weight and dimensions has been reached.

In connection with and following these tests made on the larger timbers, similar tests were made upon creosoted paving blocks. Thirty-three blocks were used in this set of tests. As it was possible to weigh the blocks much more accurately than the large timbers, the determination of the maximum absorption was much more accurately made. To determine the desirability of the preservative and to approximate an accelerated weathering, some of the specimens were dried after being immersed, and then immersed again; and others, when the maximum absorption was reached, were placed in cold storage and frozen.

A considerable part of the work of the timber tests was done at the Massachusetts Institute of Technology, being in part connected with thesis work.

Superstructures.

The superstructures over the two lock gates were studied in detail, and preliminary designs were made. The architectural features were studied in sufficient detail to settle definitely on the foundations required, which it is expected will be included in the contract for the dam and lock.

Drawbridge.

Some form of bascule bridge was decided upon during the previous year. Various bridges of this type were investigated, and detail studies made of their advantages and disadvantages. The type of bridge designed and patented by The Scherzer Rolling Lift Bridge Company was finally decided upon, and a contract made with that company on August 25 for the design of a single-leaf structure in two parts. Some of the advantages of a single-leaf structure are that it can be raised entirely on the Cambridge side of the lock, and will permit an unobstructed view from the operator's tower, as described below, of the pier below the draw; also, that it permits of somewhat simpler overhead construction for the trolley poles and wires of the electric railway, and does away with the opening across the roadway at the middle of the lock, which would be necessary in a double-leaf structure. The bridge is to be built in halves, operated by independent motors. This plan was adopted

principally on account of the width of the bridge, which is 85 feet. It is expected that it may be found desirable to operate one half at a time, before vessels have cleared the entire bridge, and thus shorten the time during which street traffic will be interrupted. It is also desirable to have a bridge operated in halves in order that, in case of accidents, one half of the bridge may be maintained for traffic while the other half is being repaired.

The adoption of this type of bridge necessitated considerable work in the study and design of retaining walls, etc., for the substructure.

Operation of Lock and Drawbridge.

Much study was given to the question of operation of the lock for passage of vessels, and to designs for warping machinery. Detail studies were made for a number of warping machines, but no positive conclusion had been reached at the end of the year. The time required for vessels of various sizes to pass through the lock and draw was calculated as closely as the various uncertainties of the problem would permit. In this connection a number of foreign articles in reference to the operation of lock gates, canals, etc., were partially translated.

Careful studies were made of various methods for operating the drawbridge, lock gates, filling gates, warping machines, etc., to the end that highway traffic be interrupted as short a time as possible, and that the passage of vessels through the lock be made with as great rapidity as is consistent with safety. A tentative decision was reached to have all the operations connected with opening and closing the drawbridge, opening and closing the lock gates, and controlling the filling gates for balancing the water level in the lock, performed at a single point and under the control of a single operator, this operator to be located in the tower, which will be made a part of the building over the lower lock gate recess. The tower is to be of sufficient height to enable the operator to get a substantially unobstructed view across the drawbridge, down the river and along the lock to the upper pier in the basin. The arrangement will be similar in principle to that of a railroad switch tower, and the responsibility for the manipulation of all the apparatus at this point will rest almost entirely on a single

individual. It may be noted that an arrangement of this kind will be somewhat difficult under existing legislation, as it is provided that the drawbridge and its operation be under the control of the Boston and Cambridge Bridge Commission, and that the lock and its operation be under the control of the Metropolitan Park Commission. It is therefore suggested that the attention of the Legislature be called to this point, and that a modification of the law, more easily to permit of this arrangement, be asked for.

Pumps.

The pumping plants required for pumping out the upper and lower lock gate recesses at the lock and the main lock itself will consist of a 13,000-gallon-per-minute, vertical, centrifugal pump, with direct-connected variable-speed motor at the lower lock gate-house; and a 5,000-gallon-per-minute, vertical, centrifugal pump, with direct-connected variable-speed motor at the upper lock gate-house. The pumping plant required at the sluices will consist of a 1,200-gallon-per-minute, horizontal pump, with direct-connected variable-speed motor, designed so that it can be occasionally submerged without injury.

Studies for the capacities and general design for these pumps were made, and specifications were drawn up and bids received on July 25. The bids, with accompanying designs and guaranteed efficiencies, were studied in detail, and as accurate analyses as possible made of the advantages of the various types of pumps and appurtenances. Consideration was given to the merits of design and details of construction, as well as to the price; and the previous experience of bidders in building pumps of the type required to operate under the conditions which will exist at the dam and lock was carefully looked up. Pumping plants installed at Schenectady and Buffalo, N. Y., were visited in connection with these studies.

A contract for these three pumps has been made.

Sluices.

Other detail studies of the sluices not mentioned elsewhere include detail design of steel and concrete roof, studies of discharge through the sluices under various conditions of river flow and tides, and study of design of gates for the central

sluice, which will be fitted to serve also as a lock for small boats.

The hydraulic conditions determining the capacity of the sluices and other openings through the dam are as follows: —

The largest freshet of which any record is obtainable occurred in February, 1886. During this freshet records were kept of the discharge over the dam and through the wheels of the Boston Manufacturing Company, near Moody Street, Waltham. These records, supplemented by additional levels and measurements, have been carefully studied, and it is estimated that the maximum discharge at this point during the flood was 3,968 cubic feet per second. The watershed of the Charles River above the dam of the Boston Manufacturing Company, as shown on Plan No. 1, is 251 square miles, but a portion of the flow of the river passes through Mother Brook into the Neponset River. The amount passing into Mother Brook is regulated by two weirs, one in the Charles River a short distance below the Newton water works pumping station, the other in Mother Brook in Dedham just above Washington Street. These two weirs are at the same elevation, the one in the Charles River being 60 feet long, while the one in Mother Brook has a length of only 30 feet. This arrangement of weirs is intended to divert one-third of the flow of the river into Mother Brook, leaving two-thirds to pass down the Charles. It is probable, however, that in times of flood more than two-thirds of the water passes down the Charles, as there is low ground at one end of this weir over which water may flow at times of extreme flood, while the banks on the sides of the weir in Mother Brook are high. The area of the watershed above these weirs is 211 square miles. Assuming that one-third of this area, or 70 square miles, is tributary to Mother Brook, there remain, of the total of 251 square miles above the Boston Manufacturing Company's dam, 181 square miles (including the area tributary to the Cambridge storage reservoirs, which at this time were, no doubt, discharging into the Charles) contributing to the estimated discharge of 3,968 cubic feet per second, or 21.9 cubic feet per second per square mile. The additional area of the watershed between the Boston Manufacturing Company's dam and Craigie bridge is 57 square miles, making a total of

238 square miles, and, assuming that the run-off of the whole watershed was at the rate of 21.9 cubic feet per second per square mile, the total discharge at Craigie bridge would have been 5,212 cubic feet per second. This estimated run-off is probably in excess of the actual, for the following reasons: —

First. — As stated above, probably more than two-thirds of the run-off above the weirs passed down the Charles River, and consequently the area from which it came was more than two-thirds of the total area; and, the area above the Boston Manufacturing Company's dam being more than 181 square miles, the run-off was less than 21.9 cubic feet per second per square mile.

Second. — The maximum rate of flow does not occur at Waltham until two or three days after the maximum rate of rainfall. The maximum rate of flow from the 57 square miles below Waltham, on the other hand, follows but a few hours after the maximum rate of rainfall, and would have passed before the crest of the main flood arrived.

In designing the sluices and other openings at the dam, it has been assumed that the waterways would be sufficient if they were capable of passing 5,700 cubic feet per second (some 10 per cent. in excess of the flood of February, 1886) without raising the basin above elevation 111 referred to a base 100 feet below Boston city base, in conjunction with continuous tides rising to elevation 113, although the basin should not be drawn down in advance below elevation 108. There is an average of about eight tides per year which rise above elevation 113, and one per year above elevation 114.

Diagram No. 1 shows the proposed openings in the dam available for flood discharge.

Diagram No. 2 shows the fluctuations in the basin at high spring, low neap and mean tides for different rates of discharge.

In case of a discharge of more than 5,700 cubic feet per second against continuous high spring tides rising to elevation 113, the basin would rise above elevation 111 unless both lock gates were open at a time when the basin and the harbor were at equilibrium and the lock used as an additional flood sluice, the lock gates, as stated under the heading of "Lock Gates," having been designed to permit of such use.

The condition which would give the highest water level in the basin would doubtless be the result of the coincidence of a large flood and a series of tides such as occurred during the storm of November, 1898, in which the steamer "Portland" was lost; these tides are characterized by both high crests and high low water, and are believed to be the most unfavorable series of tides on record for the discharge of upland flow at the dam.

As an extreme case, a study was made of the coincidence of these tides with an upland flow of 7,000 cubic feet per second. It is estimated that under these conditions the basin, if the lock gates remain closed, would reach a maximum elevation of 113.4, and would remain above elevation 113 for about four hours, and above elevation 111 for a total of about twenty-four hours. The flood assumed is one-third greater than the greatest flood on record; and a coincidence of such a flood with such a series of tides is so remote a possibility as to be hardly worthy of consideration, although, even should it occur, it appears evident that no serious damage would be done.

Sluice Gates and Gate Valves.

Much study was given to the design of sluice gates at the dam, and detail drawings were made for a wooden gate with metal fittings, and operating mechanism for hand or power operation. The question, also, of using an all-metal gate was considered, but no final conclusion had been reached at the end of the year.

The gate valves required for the pump-wells at the lock and sluices were contracted for.

Power required.

The various operations at the dam and lock, comprising drawbridge, lock gates, lock filling gates, warping machines, sluice gates, pumps at the lock and sluices, etc., require a considerable amount of power, which varies from a minimum rate of 0, when none of these operations are in progress, to a maximum rate of considerable amount when the various pumps are in operation. The power consumption is of such an intermittent character that it was early appreciated that it would be

uneconomical to install and operate an independent power plant. Electric motors, with current obtained from outside parties, were decided upon as the best and most economical way to perform the various operations. Detailed estimates of the annual amount and the maximum rate of power consumption were made. Preliminary consideration was given to the location, type and size of the various motors required.

Temporary Bridge and Approaches.

It was decided the previous year to utilize as far as possible the freight bridge of the Boston & Maine Railroad, near Craigie bridge, as a temporary bridge, constructing a new bridge on the Boston side of the draw. The railroad company began in the fall a new bridge for its own use, as required by chapter 465 of the Acts of the Legislature for the year 1903. The existing bridge was carefully examined in the field, and studies made of the methods best suited for reenforcing and surfacing it for highway purposes.

As no provision had been made in the act above referred to for the construction of the temporary bridge, the actual work on its construction was necessarily delayed until the passage of an act authorizing such construction. This was done and approved by the Governor on Feb. 9, 1905.

Plans and specifications were drawn for the new portion on the Boston end, for the reconstruction of the old portion, and for the stone block pavement on the approaches. Designs were made for the drawbridge, piers and operating machinery.

In order that this work might be pushed as rapidly as possible, and proceed in harmony with the work under the main contract for the dam and lock, the contractor for which was in a position to begin the work without delay, it was arranged that the contractor for the dam and lock should do this work, so far as required, as extra work under its contract. The lumber, machinery, paving on the bridge, paving blocks and curb stones for the approaches, and some other materials, were provided for under other contracts.

Immediately on the passage of the act authorizing the construction of this bridge, work was begun on the new portion; and as soon as traffic was removed from that portion of the

bridge in use by the Boston & Maine Railroad as a freight bridge, work was started there also.

As the act establishing the Charles River Basin Commission required that the draw in the new railroad bridge should be opposite the lock, and as the draw in the temporary bridge was only some 10 feet up stream from the new railroad draw, it was necessary that the draws in these two bridges should be in line with each other. This made an angle in the channel between the draw in the temporary bridge and the draw of the existing Craigie bridge of some 30 degrees. Six dolphins were driven on the westerly side of the channel near Craigie bridge, to assist navigation passing through the draws, and the lower end of the Craigie bridge draw pier was removed for a distance of some 100 feet, to allow long barges to change their direction from one draw channel to the other.

In strengthening the railroad bridge, 8 oak piles and 27 Norway pine piles were driven in places where the old piles were too much decayed to be repaired, and 74 piles were spliced with new 14-inch by 14-inch hard pine timbers from 6 to 8 feet in length, where the tops of the piles were partially decayed, but where the main portion of the piles below high-water mark was in good condition. Where the old stringers in the railroad bridge were in an unsatisfactory condition, new stringers were substituted for them or placed adjacent to them, and one line of new 14-inch by 14-inch stringers was placed on nearly the entire length of the bridge on the Cambridge side of the draw. The ties on the railroad bridge were generally from 1 inch to 4 or 5 inches apart, and where decayed or partially decayed, were either removed and new ties substituted, or turned one-half or one-fourth over, and the tops brought to an approximately level surface. Curb stringers were set on either side, and drift-bolted through the ties. Hard pine stringers were placed for supports for the rails of the street railway, and an underflooring for the bridge was laid, consisting of spruce plank from 1½ to 3 inches in thickness. Cast-iron scuppers, having a clear opening of 2 inches by 6 inches, were set in each gutter, from 18 to 20 feet apart.

The bridge was paved with wooden blocks, in the following manner: the flooring was covered with water-proofing, con-

sisting of four thicknesses of roofing paper, mopped with hot pitch and then given a coat of pitch by flowing. A sand cushion of varying thickness, covering up the irregularities in the underflooring, was placed in position, and the wooden block pavement of long-leaf, yellow pine, 3 inches by 3 inches by 8 inches, treated by the creo-resinate process, with the top of the block grooved on one side to a depth of 1 inch, was laid on the sand cushion. After the blocks were placed and rolled, crushed stone screenings were swept into the grooves of the blocks, and then the pavement was grouted with 1 to 1 cement and sand.

A sidewalk 8 feet wide was built of 3-inch spruce plank on the down-stream side of the bridge, and on both sides of the bridge a 3-rail fence, 4 feet high, was constructed.

The approaches to the bridge were brought to the desired grade and paved with granite blocks, the average dimensions of which were 4 inches by 6 inches by 11 inches; the sidewalks were built of brick taken from the sidewalks of the old Craigie bridge, and the fences were made of 1-inch boards, 8 feet high.

The draw in the temporary bridge is 36 feet 3 inches wide, and is divided into two roadways, one (with a sidewalk) 25 feet wide and the other 20 feet wide. The draw consists of four leaves, two leaves being operated from each side of the draw by means of electric motors connected by gearing with a 4-inch shaft. During May the timbers for the draw sticks and Samson posts were in process of construction, and the gudgeon boxes, gudgeons and shafting were being set up. During June the leaves of the draw were lowered for the first time and the machinery was adjusted, the houses over the motors, controllers, etc., were built, and the gates were placed in position.

In connection with the draw, a pier 100 feet in length and 12 to 15 feet wide was built up stream on the Boston side of the draw, and two houses, each 16 by 12 feet, were built for the use of the drawtenders. Water was brought to the drawtenders' house from Leverett Street by a 1½-inch galvanized-iron pipe some 400 feet long.

The bridge was opened for travel Sunday morning, July 2, and has been operated uninterruptedly since that time.

TEMPORARY BRIDGE — Reconstructing Old Portion of Bridge.

With one exception, the drawtenders employed on the old Craigie bridge, under the Boston and Cambridge Bridge Commission, were transferred to the temporary bridge. Until August 31 the drawtenders worked twelve hours, but since then the length of the shift has been reduced to eight hours.

Boston Marginal Conduit.

The recording gages that had been installed during the previous year in sewer overflows leading from the combined sewers tributary to the Boston main drainage system and the Metropolitan sewer, as described in the report for the year ending Sept. 30, 1904, were maintained. The results obtained by these gages are given in Table No. 1 : —

TABLE NO. 1. — *Table showing Sewage Overflow into Charles River from Boston Shore for the Year ending Sept. 30, 1905, at Points indicated.*

MONTH.	ST. MARY STREET. TIDE GATES OPEN.				HEREFORD STREET. TIDE GATES OPEN.				DARTMOUTH STREET. TIDE GATES OPEN.			
	No. of Days of Overflow.	Total Hours.	Average Hours per Day of Overflow.	Per Cent. of Total Time.	No. of Days of Overflow.	Total Hours.	Average Hours per Day of Overflow.	Per Cent. of Total Time.	No. of Days of Overflow.	Total Hours.	Average Hours per Day of Overflow.	Per Cent. of Total Time.
October,	20	90.3	4.5	12.1	15	100.7	6.7	13.5	11	61.0	5.5	8.2
November,	2	7.8	3.9	1.1	19	68.9	3.6	9.6	10	32.5	3.3	4.5
December,	2	13.3	6.7	1.8	13	14.2	1.1	1.9	23	56.0	2.4	7.5
January,	7	32.5	4.6	4.4	19	100.6	5.3	13.5	19	53.5	2.8	7.2
February,	3	2.8	.9	.4	10	30.9	3.1	4.6	9	18.5	2.1	2.8
March,	22	88.3	4.0	11.9	11	49.7	4.5	6.7	2	5.8	2.9	.8
April,	13	82.8	6.4	11.5	8	39.7	5.0	5.5	3	7.5	2.5	1.0
May,	2	5.2	2.6	.7	9	22.2	2.5	3.0	2	7.5	3.8	1.0
June,	7	17.3	2.5	2.4	20	81.2	4.1	11.3	10	25.0	2.5	3.5
July,	3	4.2	1.4	.6	18	36.2	2.0	4.9	4	6.0	1.5	.8
August,	2	4.0	2.0	.5	22	45.0	2.0	6.0	3	5.0	1.7	.7
September,	2	22.3	11.2	3.1	18	52.5	2.9	7.3	2	15.2	7.6	2.1
Totals,	85	370.8	4.4	4.2	182	641.8	3.5	7.3	98	293.5	3.0	3.4

TABLE NO. 1. — *Table showing Sewage Overflow into Charles River from Boston Shore for the Year ending Sept. 30, 1905, at Points indicated* — Concluded.

MONTH.	BERKELEY STREET.				BRIMMER STREET.			
	TIDE GATES OPEN.				TIDE GATES OPEN.			
	No. of Days of Overflow.	Total Hours.	Average Hours per Day of Overflow.	Per Cent. of Total Time.	No. of Days of Overflow.	Total Hours.	Average Hours per Day of Overflow.	Per Cent. of Total Time.
October,	11	42.6	3.9	5.7	31	243.1	7.8	32.7
November,	10	34.5	3.5	4.8	30	259.2	8.6	36.0
December,	13	41.4	3.2	5.6	20	140.3	7.0	18.9
January,	11	40.0	3.6	5.4	15	40.7	2.7	5.5
February,	8	11.1	1.4	1.7	9	40.0	4.4	6.0
March,	9	37.6	4.2	5.0	3	12.2	4.1	1.6
April,	5	22.0	4.4	3.1	12	82.5	6.9	11.5
May,	6	13.5	2.3	1.8	31	286.5	9.2	38.5
June,	14	52.2	3.7	7.3	30	275.5	9.2	38.3
July,	15	35.6	2.4	4.8	31	238.0	7.7	32.0
August,	19	41.3	2.2	5.6	31	253.5	8.2	34.1
September,	25	116.0	4.6	16.1	30	226.3	7.5	31.4
Totals,	146	487.8	3.3	5.6	273	2,097.8	7.7	24.0

The Brimmer Street gage showed a continuous overflow at low tide during October and November, and from April until the end of the year, due partly to the deposit of sand and gravel in the bottom of the sewer, and partly, as was reported after the end of the year, to a partially open blow-off valve from a water main.

A decision was reached early in the year, as the result of extended studies which were made the previous year, with the understanding that the city of Boston would proceed with the separation of sewage from storm water on the areas tributary to the Charles River, fixing the size of the Boston marginal conduit, above the connection with the basin at the upper end of the lock, with an interior area of cross-section of 41.3 square feet, the bottom of the inside masonry to be 1½ feet below Boston base, or some 2.1 feet below mean low tide.

Various designs for overflows from the conduit into the basin were considered, and a final decision adopted. Much study was given to the economical design of the masonry section, and extended studies were made of the rainfall, run-off, etc., of sewers tributary to this conduit from the dam to the Fens.

Contract plans were drawn for the section of the Boston marginal conduit extending from the dam to the southerly side of Cambridge Street, located almost entirely in the Charles-bank. In connection with this work 13 borings were taken, to depths of from 20 to 48 feet, with a total depth of 530.4 feet.

A contract was made for the portion of the conduit between the dam and the southerly side of Cambridge Street. This conduit is of concrete, having for inside dimensions a height of 7 feet 8¼ inches, and a width of 6 feet 4 inches. The first 422 feet in length are built on a gravel and clay bottom, without piles. The remainder of the conduit, so far as constructed at the end of the year, is on piles. A 10-inch underdrain has been laid about a foot below the invert. One-half-inch twisted steel rods, turned up at the ends for about a foot, laid some 4½ inches above the bottom, and ¾-inch rods laid 3 inches below the top, have been built in the concrete of the invert, both rods usually being spaced 12 inches on centers. The piles used are spruce, 10 inches in diameter at the butt and 6 inches at the tip, and were driven 2 feet apart on centers under the side walls, and 4 feet apart under the center of the conduit.

The driving of piles during the day interfered so much with the use of a cableway for excavating and backfilling that the contractor was permitted to drive piles at night, all piles being driven in that way since August 31, except on Saturday afternoons. Delays occasioned by old sea-walls, bulkheads and other obstructions, and the large quantity of water to be taken care of, caused the work to progress more slowly than required by the contract. A brick bulkhead, 12 inches thick, was built at the lower end of the conduit on September 1, and the outside face covered with a coat of cement plaster, to keep out the water. In places where the conduit passed through old sea-walls and rock fills, voids were left back of the sheeting. These voids were filled as quickly as possible, either with sand or a cement grout.

At the request of the officials of the park department of the city of Boston, the construction of that portion of the conduit through the Women's Gymnasium at the southerly end of the Charlesbank was put off until as late in the fall as possible, in order to not interfere with the use of this portion of the park during the summer months, when the schools are closed. In order, however, to complete the work at Cambridge Street before traffic should be diverted to the new Cambridge bridge, the contractor started a force on that end of the work September 20. Unexpected difficulties were encountered at this point. The excavation was partially through an old rock fill, which allowed tide water from the river to enter the trench freely. Trouble was also experienced with the pumps.

The conduit was built largely under the sidewalk next Charles Street, from Poplar Street to Fruit Street. The park department of the city of Boston planned to relocate the sidewalk, after the construction of the conduit, by moving it nearer to the street; and, as the conduit would then come in the park area, the department desired to have the conduit trench surfaced with loam to a depth of 18 inches. It was agreed that the Charles River Basin Commission should furnish 12 inches of this loam, and would not be required to replace the previously existing brick sidewalk. An agreement was therefore made with the contractor for furnishing the loam, as extra work under the contract.

Dredging in the Basin.

Preliminary studies were made for dredging channels of various widths and depths at the upper end of the basin, and for disposing of the material in filling the shallow arms and pools adjacent to the river. This work is necessary in order to provide a sufficient depth of water at the upper end of the basin to render it attractive and to permit its use for pleasure purposes. It will also assist in the destruction of malarial mosquitoes by destroying their breeding places. Further surveys will be required before reaching definite conclusions.

Soundings were made in the lower basin, where dredging is necessary to give the required depth of water for navigation purposes.

Broad and Lechmere Canals.

Soundings were made in Broad Canal for a length of 3,475 feet, the width of the canal varying from 75 to 125 feet; and in Lechmere Canal for a length of 2,043 feet, the canal varying in width from 100 to 127 feet. These soundings were taken not more than 10 feet apart, on cross-section lines 25 feet apart.

Land Takings.

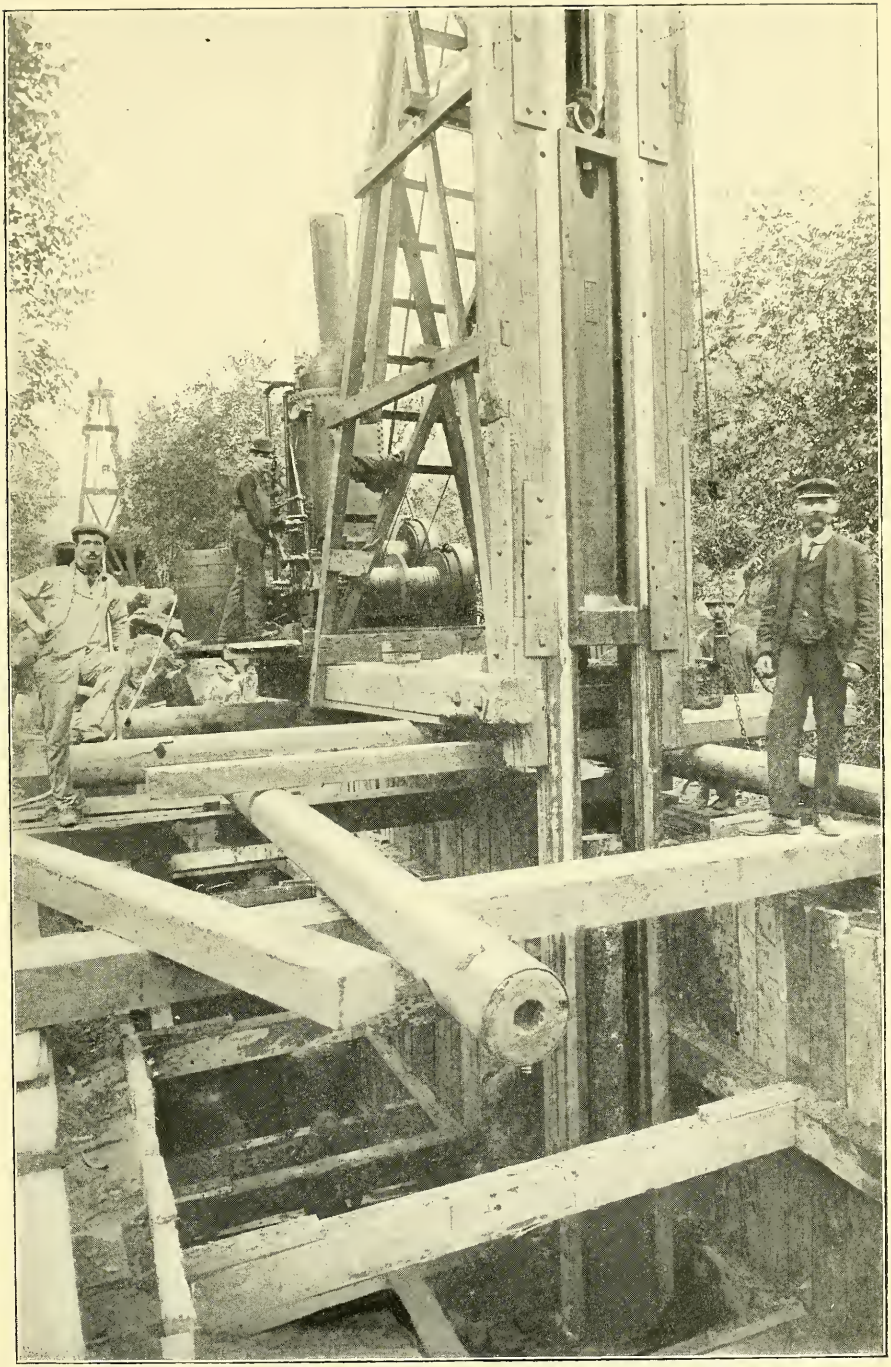
A taking plan was made of the land of George O. Proctor at the westerly end of the dam. This property is bounded by Commercial Avenue, Bridge Street, the river and Lechmere Canal.

A taking plan was also made of property claimed by the heirs of Caroline M. McGlenen near the Boston end of Craigie bridge.

Summary of Borings.

The following is a summary of the borings made in the basin and the canals and for the Boston marginal conduit: —

	Number.	Total Depth (Feet).
Made during the year,	13	530.4
Made previous to Oct. 1, 1904,	150	4,535.3
Total,	163	5,065.7



BOSTON MARGINAL CONDUIT — Driving Piles.

Summary of Soundings.

The work of taking soundings, which had been started only a week previous to the end of the time covered by the last annual report, was continued during the fall as long as the weather permitted, and was resumed in the early spring. The area covered by the soundings amounted to 45.34 acres, which, added to the area sounded during the previous year, makes a total of 47.84 acres. The method of making these soundings was described in the report of the chief engineer for the year ending Sept. 30, 1904.

Upland Flow of the Charles River.

Careful studies of upland flows and the discharge of the Charles River at the dam were made.

A recording gage, showing the depth of water flowing over the dam at the Waltham Bleachery, was maintained, and weekly current meter observations were taken of the flow in the canal past the Bleachery dam. Although one heavy rainfall was recorded on September 3 and 4, amounting to some 4½ inches, it did not increase very materially the flow on the lower portion of the river, and neither the maximum nor the minimum flow of this year approaches the record of the previous year.

Table No. 2 shows the estimated average flow of the Charles River at Waltham for weekly periods during the year ending Sept. 30, 1905. The area of the watershed above "The Bleachery" is taken to be 169 square miles; this excludes 70 square miles assumed to be tributary to Mother Brook and 24 square miles tributary to the Cambridge reservoirs. Whenever these reservoirs overflowed into the Charles, the amount, as furnished by Mr. L. M. Hastings, city engineer of Cambridge, has been deducted from the total discharge measured at "The Bleachery."

Table No. 3 shows the number of days during the year ending Sept. 30, 1905, when the upland flow of the Charles River at Craigie bridge, estimated from the records kept by the Charles River Basin Commission at the Waltham Bleachery, was more than 500 cubic feet per second for twenty-four hours.

Table No. 4 shows the length of time during which a normal tide will be higher than the water in the basin, and the rise of the basin during that interval for various rates of upland flow.

Diagram No. 3 shows the daily flow of the Charles River at "The Bleachery," Waltham, in connection with the rainfall at Chestnut Hill, taken from the records of the Metropolitan Water Works.

TABLE NO. 2. — *Estimated Weekly Average Flow of Charles River at the Waltham Bleachery for the Year ending Sept. 30, 1905.*

WEEK ENDING —	Cubic Feet per Second.	Cubic Feet per Second per Square Mile.[1]	WEEK ENDING —	Cubic Feet per Second.	Cubic Feet per Second per Square Mile.[1]
1904.			**1905.**		
Oct. 8, . . .	67	.40	Apr. 8, . . .	577	3.41
15, . . .	56	.33	15, . . .	585	3.46
22, . . .	68	.40	22, . . .	426	2.52
29, . . .	104	.62	29, . . .	315	1.86
Nov. 5, . . .	62	.37	May 6, . . .	223	1.32
12, . . .	70	.41	13, . . .	151	.89
19, . . .	98	.58	20, . . .	110	.65
26, . . .	112	.66	27, . . .	162	.96
Dec. 3, . . .	91	.54	June 3, . . .	78	.46
10, . . .	84	.50	10, . . .	97	.57
17, . . .	66	.39	17, . . .	98	.58
24, . . .	57	.34	24, . . .	139	.82
31, . . .	66	.39	July 1, . . .	192	1.14
			8, . . .	137	.81
1905.					
Jan. 7, . . .	176	1.04	15, . . .	61	.36
14, . . .	525	3.11	22, . . .	40	.24
21, . . .	392	2.32	29, . . .	37	.22
28, . . .	240	1.42	Aug. 5, . . .	53	.31
Feb. 4, . . .	125	.74	12, . . .	53	.31
11, . . .	145	.86	19, . . .	46	.27
18, . . .	117	.69	26, . . .	53	.31
25, . . .	128	.76	Sept. 2, . . .	49	.29
Mar. 4, . . .	121	.72	9, . . .	207	1.22
11, . . .	174	1.03	16, . . .	292	1.73
18, . . .	474	2.81	23, . . .	188	1.11
25, . . .	565	3.34	30, . . .	113	.67
Apr. 1, . . .	655	3.88			

[1] Area of watershed is 169 square miles.

TABLE No. 3. — *Number of Days during Year ending Sept. 30, 1905, when Estimated Upland Flow of Charles River at Craigie Bridge was More than 500 Cubic Feet per Second for Twenty-four Hours, from Records kept by the Charles River Basin Commission at "The Bleachery," Waltham.*

MONTH.	500–750 Cubic Feet per Second (Days).	750–1,000 Cubic Feet per Second (Days).	1,000–1,500 Cubic Feet per Second (Days).	1,500–2,000 Cubic Feet per Second (Days).	2,000–2,500 Cubic Feet per Second (Days).	Total Number of Days exceeding 500 Cubic Feet per Second.	Rainfall at Chestnut Hill (Inches).	Average Rainfall on Sudbury Watershed for Thirty Years (Inches).
1904.								
October,	–	–	–	–	–	–	2.21	4.23
November,	–	–	–	–	–	–	1.81	3.96
December,	–	–	–	–	–	–	2.81	3.81
1905.								
January,	7	3	–	–	–	10	5.49	4.21
February,	–	–	–	–	–	–	2.27	4.34
March,	7	8	5	–	–	20	3.34	4.59
April,	7	14	–	–	–	21	3.08	3.61
May,	–	–	–	–	–	–	1.65	3.34
June,	–	–	–	–	–	–	5.38	3.09
July,	–	–	–	–	–	–	1.55	3.67
August,	–	–	–	–	–	–	3.58	4.05
September,	–	–	–	–	–	–	5.93	3.32
Totals,	21	25	5	–	–	51	39.10	46.22
1903–04,	29	18	13	5	1	66	45.98	–

TABLE No. 4. — *Time during which a Normal Tide will be Above the Water in the Basin, and Rise of Basin during that Interval for Various Rates of Upland Flow.*

Rate of Upland Flow (Cubic Feet per Second).	Time Harbor will be Above Basin.		Rise of Basin (Feet).	Rate of Upland Flow (Cubic Feet per Second).	Time Harbor will be Above Basin.		Rise of Basin (Feet).
	Hrs.	Min.			Hrs.	Min.	
500	3	48	.20	3,000	3	19	1.02
1,000	3	42	.39	4,000	3	8	1.28
1,500	3	36	.56	5,000	2	58	1.51
2,000	3	30	.72	6,000	2	49	1.71
2,500	3	25	.87				

Traffic through Draw of Craigie Bridge and of Temporary Bridge.

A record was kept of the traffic through the draw of Craigie bridge until the temporary bridge was completed, when the records were transferred to the latter bridge. This record gives the tonnage, draft and time of passage of vessels of different kinds. Some of the results of the records obtained are shown by the following diagrams: —

Diagram No. 4 shows weekly totals of cargoes, in tons, not including the material furnished for the Charles River dam, passing Craigie bridge and the temporary bridge for the year ending Sept. 30, 1905.

Diagram No. 5 shows the monthly totals of cargoes, in tons, not including the material furnished for the Charles River dam, passing Craigie bridge since Sept. 30, 1899. Except for a slight increase during the current year, this diagram indicates quite a regular decrease in the amount of tonnage each year for the last six years, with the exception of the year 1900–01, when the construction of the foundations for the piers of the new Cambridge bridge caused a large increase in the traffic.

Diagram No. 6 shows the yearly number of vessels passing Craigie bridge since Sept. 30, 1885, and the number of times the draw has been opened per year since Sept. 30, 1871, the only complete years covered by existing records.

The winter of 1904–05 was severe, ice forming in the river before Christmas and continuing until the latter part of February.

Miscellaneous Engineering Work.

Eighty finished plans were prepared during the year, besides numerous studies and designs. A number of working drawings for the dam and lock, also, were in a partially completed condition at the end of the year. One hundred and seventy-three plans were indexed and filed, which, with previous plans, make a total of 435.

One hundred and twelve photographs were taken by Mr. Luther H. Shattuck.

Storage Shed.

A storage shed, 64 feet long by 29 feet wide, was built at the corner of Charles and Leverett streets, to take care of the

twisted steel rods which are to be used in the bottom of the lock and of the Boston marginal conduit. On one side of this is a lime box, some 33 feet long by 6 feet wide by 18 inches deep, in which the rods are kept in air-slacked lime, after being bent. For use in connection with these rods a hydraulic bending machine was installed in the shed. This bending machine consists of a hydraulic jack, with a cylinder some 6 inches in diameter, to each end of which is connected a 1-inch pipe controlled by 3-way cocks each side of the delivery pipe from the force pump. A pressure of 900 pounds per square inch has been obtained from this machine, and it requires less than 600 pounds pressure to bend a rod 1⅛ inches in diameter. A Watson-Stillman hydraulic shear was also installed in the storage shed, and is used to cut the twisted steel rods into the required lengths.

Contracts

Nineteen contracts were let during the year. The preparation of the various contract plans and specifications, estimates, supervision of the work, etc., occupied a considerable portion of the time of the engineering force. A detailed statement of the contracts made during the year is given in Appendix B.

Following are additional descriptions of some of these contracts, except so far as the work done under them has already been described under the headings of "Dam and Lock," "Temporary Bridge and Approaches," and "Boston Marginal Conduit."

Contract No. 1, Holbrook, Cabot & Rollins Corporation. — Dam and Lock in the Charles River, Boston and Cambridge.

On Jan. 14, 1905, a contract was made with the Holbrook, Cabot & Rollins Corporation for the construction of the dam and lock. The amount of this contract, on the basis of award, is $801,607.50.

The contract provides for the following work: —

The main portion of the dam is to be constructed of earth filling between masonry retaining walls, supported on pile foundations. Within the coffer-dam to be built at the Boston end are to be constructed the lock, a portion of the Boston marginal conduit, with gate-chambers, connections to the basin

and other structures. Within the coffer-dam to be built at the Cambridge end are to be constructed a portion of the Cambridge marginal conduit, and sluices for the purpose of discharging the flow of the river through the dam, the central one of which, with its top at a higher level than the others, will serve also as a lock for small boats. The sluice next the Cambridge side will be connected with the marginal conduit. Gate-chambers and other structures will be connected with the masonry of the sluices. The structures within the coffer-dams will be mainly of concrete masonry on pile foundations. From the lock to the sluices on the Cambridge side there is to be constructed a so-called shut-off dam, for the purpose of arresting the tidal flow. Excavations by dredging will be required in the Broad and Lechmere canals, in the basin and in the vicinity of the outlets of the sluices and marginal conduits. Excavation at the dam and lock, by dredging and other methods, will be required at the sites of the retaining walls and shut-off dam, and from the area enclosed by the coffer-dams. The material to be obtained from the above excavation will be used at the dam unless the contractor is required to deposit some of the material between the Cambridge bridge and Fairfield Street, on the Boston side of the basin, or in the basin below the Cambridge bridge. The earth from the above excavation not being sufficient to complete the earth portion of the dam, additional filling is to be obtained from other sources. Coarse gravel and riprap will be required at the shut-off dam and at the ends of the lock and sluices. The Leverett Street, Chambers Street and Bridge Street sewers are to be connected with the marginal conduits.

The following table gives a summary of the principal quantities and prices: —

Items.	Quantities.	Maximum Prices.	Minimum Prices.
Coffer-dam at the Boston end, . . .	–	$70,000 00	$70,000 00
Coffer-dam at the Cambridge end, . . .	–	27,000 00	27,000 00
Earth excavation, ...	730,000 cu. yds.	45	34
Coarse gravel, ...	7,000 cu. yds.	75	75

Items.	Quantities.	Maximum Prices.	Minimum Prices.
Broken stone or screened gravel,	5,700 cu. yds.	$1 50	$1 50
Riprap,	9,700 cu. yds.	1 50	1 50
Round piles in place,	468,500 lin. ft.	30	14
Spruce lumber in place,	540 M. ft. B. M.	50 00	35 00
Concrete masonry,	41,000 cu. yds.	6 50	4 50
Granolithic surfacing,	1,800 sq. yds.	1 00	1 00
Ashlar masonry,	2,710 cu. yds.	20 25	18 00
Face dressing,	20,000 sq. ft.	80	50
Iron and other metal work to be placed,	500 tons	25 00	25 00
Furnishing and laying vitrified pipe,	5,000 lin. ft.	60	15

During the months of January and February the contractor was gradually accumulating the plant to be used in the work, consisting of engines, boilers, derricks, pumps, etc., and work was started on the main contract March 1, by removing the iron fence along the sea-wall at the northeasterly end of the Charlesbank. Piles were driven for the foundation of a storage bin for sand and gravel to be used for the concrete, and some of the posts and framing were set in place.

The first sheeting for the coffer-dam on the Boston side was driven on March 21. At 7 A.M., on July 5, the work of tearing down the old Craigie bridge was started. The dredging for the foundation for the lock was begun on April 27. The timber portion of the coffer-dam on the Boston side was completed on September 29.

The first piles in the temporary bridge were driven on March 2. The Boston & Maine Railroad began sending trains over its new bridge on March 27. The work of removing piles in the old Boston & Maine drawbridge was begun on March 31.

The total value of the work performed, as shown by the September estimate, was $119,917.79, the principal items of which were as follows: —

Coffer-dam at the Boston end,	46	per cent. completed.
Coffer-dam at the Cambridge end,	4.5	per cent. completed.
Earth excavation,	113,115	cu. yds.
Round piles in place (exclusive of coffer-dams),	18,170	lin. ft.

Contract No. 2, United States Wood Preserving Company. — Wooden Block Paving for Temporary Bridge, Boston and Cambridge.

On March 23, 1905, a contract was made with the United States Wood Preserving Company for furnishing and laying the wooden block paving for the temporary bridge. The amount of this contract, on the basis of award, is $11,700.

The contract called for paving the temporary bridge with creo-resinate wood block pavement, with a maintenance guarantee for four years.

The wood blocks were received and the unloading of a vessel was started on May 8, and completed May 11. Laying tar paper for the waterproofing was started May 27, and the first of the wood blocks were laid on June 2. The laying of the wood blocks was completed on Sunday, June 18. The regular traffic was not turned over the bridge until July 2.

Owing to the unsatisfactory condition of the roadway, the amount allowed on this contract at the end of the year was $4,782.52.

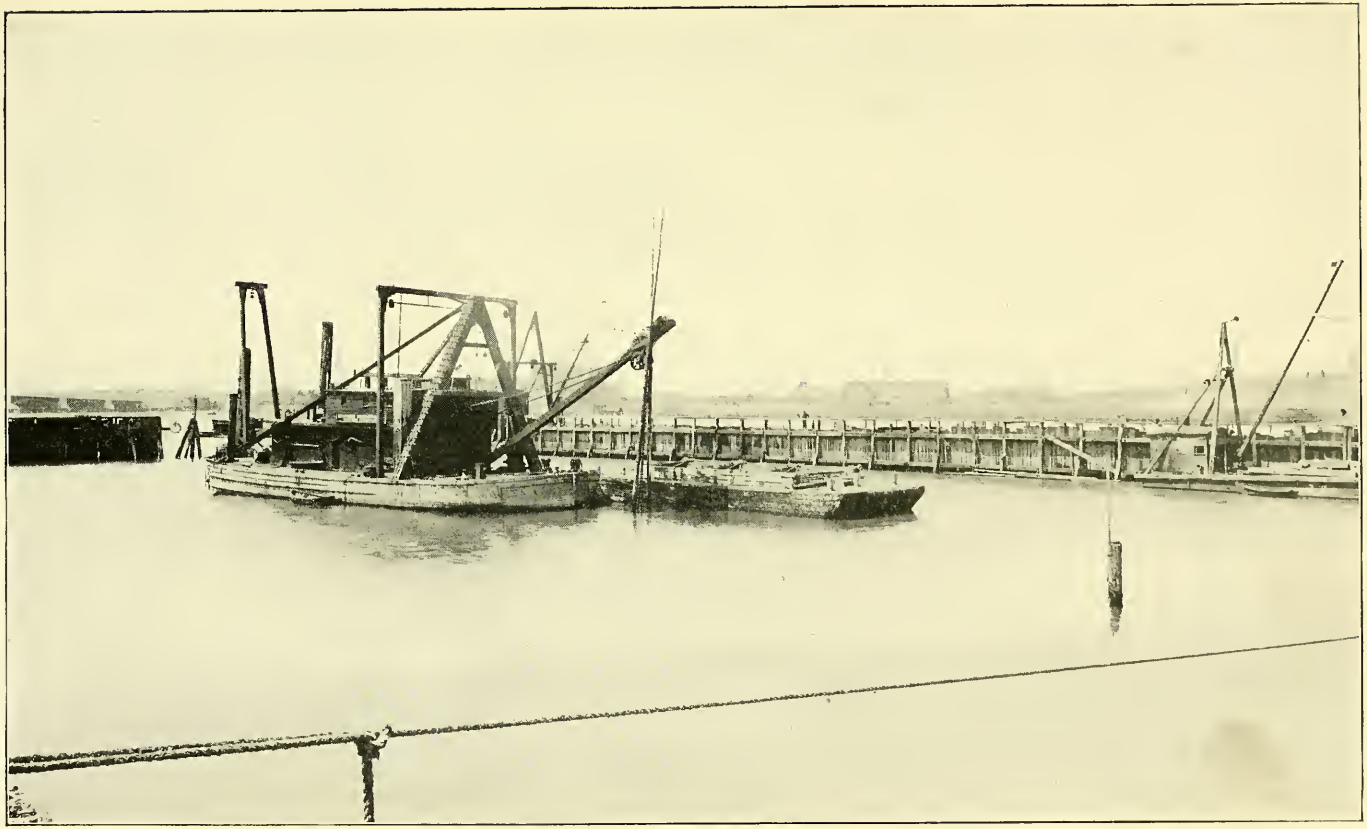
Contract No. 3, James Driscoll & Son. — Section 2 of the Boston Marginal Conduit, Boston.

On June 13, 1905, a contract was made with James Driscoll & Son for the construction of the Boston marginal conduit, between the dam and the southerly side of Cambridge Street. The amount of this contract, on the basis of award, is $50,600.

The contract calls for the construction of the main conduit and of an overflow conduit extending from the main conduit to the Charlesbank wall, a short distance north of Cambridge Street. The contract provides for piles where necessary, for reenforcing the concrete with steel rods furnished by the Commission, and for the temporary crossings of the overflows from the sewers at Fruit Street and Cambridge Street. The principal items of the preliminary estimate were : —

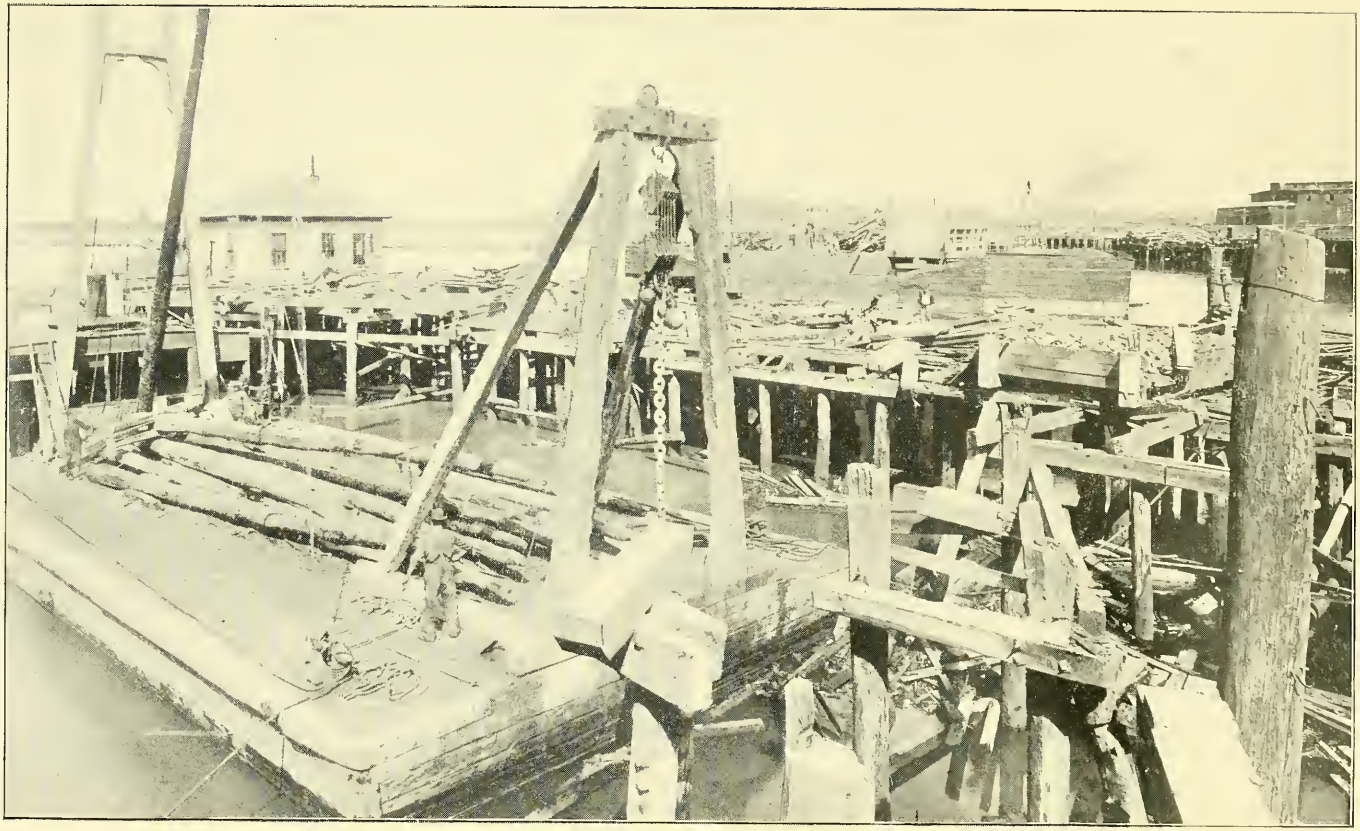
Earth excavation and refill (main conduit),	1,800 lin. ft.
Earth excavation and refill (overflow conduit),	175 lin. ft.
Piles,	62,000 lin. ft.
Underdrain,	2,000 lin. ft.

DAM AND LOCK — Guide Piles for Coffer-dam at Lock.



DAM AND LOCK — Westerly Side of Coffer-dam and Dredging at Lock.

DAM AND LOCK — Coffer-dam, Boiler and Storage Bin at Lock.



DAM AND LOCK — Removing Craigie Bridge.

Concrete masonry,	2,700 cu. yds.
Placing iron and other metal work,	45 tons.
Sheeting left in place,	70 M. ft. B. M.

Work was started under this contract on June 21. A stiff-leg derrick was delivered on June 23, and on June 26 excavation for a pump-well began. A Carson-Lidgerwood cableway, about 300 feet long between towers, was put in operation July 8, and continued on the work until the end of the year. The first section of the concrete invert was laid July 11, three weeks after starting work. A Smith concrete mixer was delivered and put in operation July 26. Lehigh and Whitehall cements have been used for the concrete. Pile-driving was begun August 12.

The total value of the work performed, as shown by the September estimate, was $15,261.69, the principal items of which were as follows: —

Earth excavation and refill (main conduit),	668.9 lin. ft.
Piles,	6,928.8 lin. ft.
Underdrain,	672.0 lin. ft.
Concrete masonry,	818.1 cu. yds.
Placing iron and other metal work,	8.0 tons.
Sheeting left in place,	19.0 M. ft. B. M.

Contract No. 4, Camden Iron Works. — Cast-iron Pipes and Special Castings, Boston and Cambridge.

On July 18, 1905, a contract was made with the Camden Iron Works for a portion of the cast-iron pipes and special castings to be embedded in and attached to the masonry in connection with the dam and lock and the Boston marginal conduit. The amount of the contract, on the basis of award, is $5,640.75.

The contract includes the cast-iron pipes and special castings for suction pipes and discharge pipes leading to pump-wells at the lock and sluices, the conduit under the lock, outlets from marginal conduits and overflows, and other purposes. The engineer's estimate of quantities is as follows: —

Straight pipe, of sizes varying from 6-inch to 60-inch,	110.0 tons.
Standard special castings,	15.1 tons.
Special castings,	22.2 tons.

Considerable progress had been made on this contract prior to the end of the year, but no pipe had been received or payments made thereon.

Contract No. 5, Henry R. Worthington. — Furnishing and erecting Pumps, Boston and Cambridge.

On Sept. 30, 1905, a contract was made with Henry R. Worthington for furnishing and erecting pumps, the amount of the contract being $9,533.

The contract calls for furnishing and erecting three pumps, with motors, suction pipes, foot valves, controllers and appurtenances, for the purpose of emptying the lock, lock gate recesses, and sluices at the dam, one pump having a capacity of 13,000 gallons per minute, another 5,000 gallons per minute, and the third 1,200 gallons per minute. The contract also provides that the contractor shall keep the pumps in repair for two years after they are erected and tested.

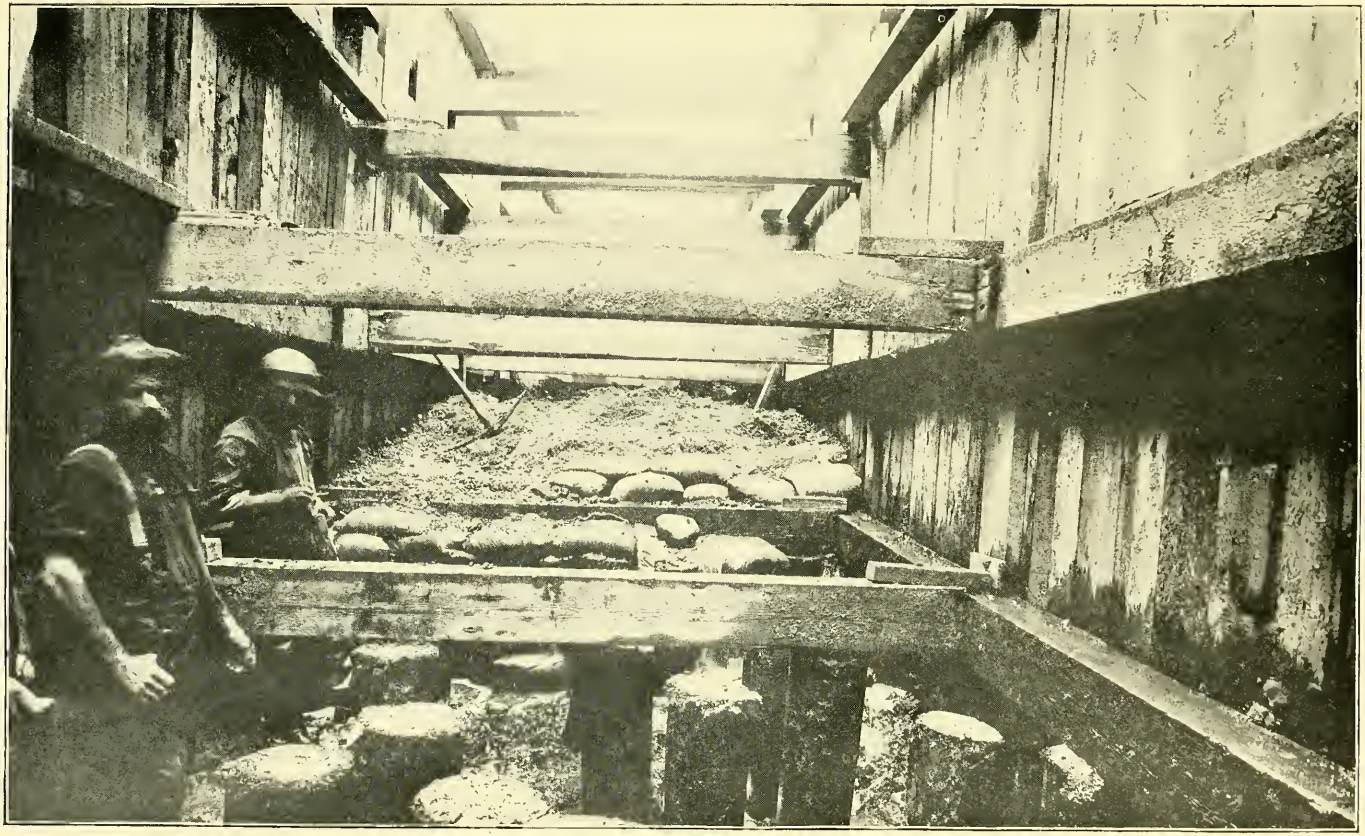
Contract No. 6, Gibby Foundry Company. — Furnishing Castings and Other Metal, Boston and Cambridge.

On July 27, 1905, a contract was made with the Gibby Foundry Company for castings and other metal required in connection with the dam and lock and the Boston marginal conduit. The amount of the contract, on the basis of award, is $6,013.74.

This contract covers the greater part of the special castings required at the lock and the lower portion of the Boston marginal conduit. The principal items of the preliminary estimate were : —

Unfinished iron castings,	27,320 pounds.
Finished iron castings,	82,350 pounds.
Finished steel castings,	5,260 pounds.
Rods, bolts, etc.,	5,270 pounds.

At the end of the year some 3 per cent. of the total value of the contract had been delivered at the dam, but no payments had been made to the contractor.



BOSTON MARGINAL CONDUIT — Foundation Piles.

BOSTON MARGINAL CONDUIT — View at Fruit Street showing Cableway and Pile-driver.

Operating Machinery for Temporary Draw.

In addition to the contracts enumerated in Appendix B, Mr. H. J. Shaw erected the machinery of the temporary draw, under an arrangement by which he furnished the machine labor at $0.50 per hour, blacksmith labor (including blacksmith and helper) at $0.80 per hour, and the cast iron at $0.005 per pound, in addition to his cost price. The other machinery, trunnions and weights for operating the draw, so far as furnished by him, were at cost. The amount paid Mr. Shaw under this arrangement was $3,785.13.

Respectfully submitted,

HIRAM A. MILLER,
Chief Engineer.

Boston, Dec. 26, 1905.

APPENDIX.

Appendix A.

Chapter 465 of the Acts of 1903, as amended by Chapter 65 of the Acts of 1905.

An Act to authorize the Construction of a Dam across the Charles River between the Cities of Boston and Cambridge.

Be it enacted, etc., as follows:

Charles river basin commission, appointment, term, etc.

Section 1. The governor of the Commonwealth, with the advice and consent of the council, shall appoint three commissioners, residents of the metropolitan parks district, who shall constitute the Charles river basin commission, hereinafter called the commission, and who shall be sworn before entering upon the duties of their office. One commissioner shall be designated by the governor as chairman, and two commissioners shall constitute a quorum. The term of office shall be three years, and all vacancies shall be filled by the governor, with the advice and consent of the council. Any commissioner may be removed by the governor, with the advice and consent of the council, for such cause as he shall deem sufficient and shall assign in the order of removal. Each commissioner shall receive an annual salary of such amount as the governor and council shall determine.

Compensation.

Powers and duties.

Section 2. The commission may appoint a secretary, engineers and assistants, shall keep accurate accounts of its expenditures, and shall make an annual report of its doings, including an abstract of its accounts, to the governor and council. The commission whenever the Commonwealth has been authorized by the United States to build a dam and lock under the provisions of this act, shall proceed to do the work herein required of it, and shall in the meantime make examinations and plans therefor.

Dam to be constructed across Charles river, etc.

SECTION 3. The commission shall construct across Charles river between the cities of Boston and Cambridge, a dam, at least sufficiently high to hold back all tides and to maintain in the basin above the dam a substantially permanent water level not less than eight feet above Boston base. The dam shall occupy substantially the site of the present Craigie bridge, which shall be removed by the commission. *The commission may construct or otherwise provide a temporary highway bridge and approaches thereto for the use of teams and pedestrians during the construction of the dam.* The dam shall be not less than one hundred feet in width at said water level and a part thereof shall be a highway and the remainder shall be a highway, or a park or parkway, as the commission shall determine. The dam shall be furnished with a lock not less than three hundred and fifty feet in length between the gates, forty feet in width and thirteen feet in depth below Boston base, and shall be built with a suitable drawbridge or drawbridges, wasteways and other appliances. The part of the dam used as a highway shall be maintained and operated in the same manner as the Cambridge bridge, and under the laws now or hereafter in force relating to said bridge.

Navigable channels to be dredged.

SECTION 4. The commission shall dredge navigable channels in the basin from the lock to the wharves between the dam and Cambridge bridge, to Broad canal and to Lechmere canal, the channel to be not less than one hundred feet in width and eighteen feet in depth; shall dredge Broad canal to such depths as will afford to and at the wharves thereon not less than seventeen feet of water up to the Third Street draw, not less than thirteen feet of water from the Third Street draw to the Sixth Street draw, and not less than eleven feet of water from the Sixth Street draw to the railroad draw, and not less than nine feet of water for one hundred and twenty-five feet above the railroad draw; shall dredge Lechmere canal to such depths as will afford to and at the wharves thereon not less than seventeen feet of water up to and including Sawyer's lumber wharf,

and not less than thirteen feet of water from said wharf up to the head of the canal at Bent street; all depths aforesaid to be measured from the water level to be maintained in the basin.

Manner of dredging, etc.

The commission shall do all such dredging and all strengthening of the walls of the canals and of the basin where dredging is done by the driving of prime oak piles two feet on centres along the front of said wharves or walls, and all removing and relocating of pipes and conduits made necessary by such dredging, so that vessels requiring a depth of water not exceeding the respective depths above prescribed can lie alongside of, and in contact with, the wharves; and this work shall be done in such manner as to cause the least possible inconvenience to abutters, and shall be finished on or before the completion of the dam; and after the walls or wharves have been so strengthened, all repairs on or rebuilding of the walls and wharves shall be done by the abutters.

Certain other dredging to be done, etc.

The commission shall do such dredging in the basin outside of the channels aforesaid as may be necessary for the removal of sewage, sludge or any offensive deposit; shall do such other dredging as it shall deem proper, and shall take all proper measures for the destruction of malarial mosquitoes in the basin and its vicinity.

Marginal conduits to be constructed, etc.

SECTION 5. The commission, before the completion of the dam, shall construct marginal conduits on the north side of the basin from the outlet of the overflow channel in Binney street to a point below the dam, and on the south side of the basin from the present outlet of the Back Bay Fens to a point below the dam, and may construct an extension thereof toward, or to, St. Mary street, the conduits to be used to receive and conduct below the dam the overflow from sewers and the surface drainage and other refuse matter which would otherwise pass into the basin.

Certain lands, etc., may be taken, etc.

SECTION 6. The commission, for the purpose of carrying out the provisions of the preceding sections, may from time to time take in fee or otherwise, by

purchase or otherwise, for the Commonwealth, or the city of Boston or the city of Cambridge, as the commission shall determine, lands, flats and lands covered by tide-water on Charles river, by filing in the registry of deeds for the county and district in which the lands or flats are situated a description thereof, sufficiently accurate for identification, signed by a majority of the commissioners; and any person whose property is so taken may have compensation therefor as determined by agreement with the commission, and if they cannot agree the compensation may be determined by a jury in the superior court for the county where the property is situated under the same provisions of law, so far as they are applicable, which apply in determining the value of lands taken for highways under chapter forty-eight of the Revised Laws, upon petition therefor by the commission, or by such person, filed in the clerk's office of said court against the Commonwealth or the city for which the lands or flats are taken within one year after the taking, and costs shall be taxed and execution issued as in civil cases.

The metropolitan park commission to have exclusive control of dam, etc.

SECTION 7. The metropolitan park commission, when the work provided for in the preceding sections is finished, shall, subject to the powers vested by law in the state board of health, have exclusive control of the dam and lock and of the basin and river between the dam and the city of Waltham, as a part of the metropolitan parks system, and of all poles, wires and other structures placed or to be placed on, across, over or in any part of said basin, dam or lock, and of the placing thereof, except the part of the dam used as a highway and the bridges and other structures erected by any city or town within its limits and upon its own lands; may make reasonable rules and regulations, not impairing freight traffic, for the care, maintenance, protection and policing of the basin; and throughout the year shall operate the lock without charge, maintain the lock, channels and canals aforesaid at the depths aforesaid, and clear of obstructions caused by

May make rules and regulations, etc.

natural shoaling or incident to the building of the dam, and maintain the water in the basin at such level and the lock, channels and canals sufficiently clear of obstructions by ice so that any vessel ready to pass through the lock, and requiring no more depth of water than aforesaid, can pass through to the wharves aforesaid. In the event of an emergency, requiring the temporary reduction of such level, notice thereof shall be given to the occupants of said wharves, and such reduction shall not be lower nor continue longer than the emergency requires. Said metropolitan park commission may order the removal of all direct sewage or factory waste as a common nuisance from the river and its tributaries below the city of Waltham; and no sewer, drain, overflow or other outlet for factory or house drainage shall hereafter be connected with the basin below said city without the approval of the metropolitan park commission.

Notice to be given in case of emergency requiring temporary reduction of level, etc.

Removal of direct sewage or factory waste may be ordered, etc.

Section 8. The Commonwealth shall in the first instance pay all expenses incurred in carrying out the provisions of the preceding sections, and the same shall, except as provided in the following section, constitute part of the cost of construction and maintenance of the metropolitan parks system; and in addition to the amounts heretofore authorized for such construction the treasurer and receiver-general shall, from time to time, as authorized by the governor and council, issue notes, bonds or scrip, in the name and behalf of the Commonwealth, entitled Charles River Basin Loan, to the amount which the commission may deem necessary for the expenses incurred under the first six sections of this act; and all acts and parts of acts relative to loans for such construction and providing for their payment shall, so far as they may be applicable and not inconsistent herewith, apply to such notes, bonds and scrip and to their payment.

Payment of expenses.

Charles River Basin Loan.

Section 9. The commissioners next appointed under the provisions of chapter four hundred and nineteen of the acts of the year eighteen hundred and ninety-

Apportionment of expenses, etc.

nine, and amendments thereof, in apportioning the expenses of maintaining the metropolitan parks system shall include as part thereof the expense of maintenance incurred under the preceding sections of this act; shall also determine, as they shall deem just and equitable, what portion of the total amount expended for construction under sections three, four, five and six of this act shall be apportioned to the cities of Boston and Cambridge as the cost of the removal of Craigie bridge and the construction of a suitable bridge in place thereof, and the remainder shall be considered and treated as part of the cost of construction of the metropolitan park system. The treasurer and receiver-general shall determine the payments to be made each year by said cities, one half by each, to meet the interest and sinking fund requirements for the amounts apportioned to them as the cost of such bridge, and the same shall be paid by each city into the treasury of the Commonwealth as part of its state tax.

City of Boston to do certain dredging, construct conduits, sewer, etc.

SECTION 10. The city of Boston, by such officer or officers as the mayor may designate, shall forthwith after the passage of this act, do such dredging in the Back Bay Fens as the board of health of said city may require, shall construct a conduit between Huntington avenue and Charles river, to form an outlet into Charles river for the commissioners' channel of Stony brook, shall reconstruct the present connections between the river and the Fens so as to allow free access of water from the river into the streams and ponds in the Fens and thence into the river, and shall construct a sewer in the rear of the houses on the north side of Beacon street between Otter and Hereford streets. Such officer or officers may construct a conduit between Green street and Forest Hills and may construct or rebuild within five years one or more conduits for Stony brook between the westerly side of Elmwood street and the Fens: *provided, however*, that the expense of such conduits between Green street and Forest Hills and between Elmwood street and the Fens shall be paid for

Proviso.

out of the annual appropriation for sewer construction under the provisions of chapter four hundred and twenty-six of the acts of the year eighteen hundred and ninety-seven and acts in amendment thereof or in addition thereto.

Wall or embankment may be built on Boston side of Charles river.

SECTION 11. The board of park commissioners of Boston may, with the approval of the mayor, build a wall or embankment on the Boston side of Charles river beginning at a point in the southwest corner of the stone wall of the Charlesbank, thence running southerly by a straight or curved line to a point in Charles river not more than three hundred feet distant westerly from the harbor commissioners' line, measuring on a line perpendicular to the said commissioners' line at its intersection with the southerly line of Mount Vernon street, but in no place more than three hundred feet westerly from said commissioners' line; thence continuing southerly and westerly by a curved line to a point one hundred feet or less from the wall in the rear of Beacon street; thence by a line substantially parallel with said wall to the easterly line of the Back Bay Fens, extended to intersect said parallel line.

Certain lands, flats, etc., may be taken for a public park.

SECTION 12. The board of park commissioners of said city may take, in fee or otherwise, by purchase or otherwise, for said city, for the purpose of a public park such lands, flats and lands covered by tide-water between Charles, Brimmer and Back streets and the line of the wall or embankment aforesaid, as the mayor shall approve, by filing in the registry of deeds for the county of Suffolk a description thereof sufficiently accurate for identification, signed by a majority of the commissioners, and shall construct a public park on the lands so taken; and any person whose property is so taken may have compensation therefor as determined by agreement with the board, and if they cannot agree the amount thereof may be determined by a jury in the superior court for the county of Suffolk, under the same provisions of law, so far as they may be applicable, which apply in determining the value of lands taken

for highways under chapter forty-eight of the Revised Laws, upon petition therefor by the board, or by such person, filed in the clerk's office of said court against said city within one year after the taking, and costs shall be taxed and execution issued as in civil cases.

City of Boston to pay certain expenses, etc.

SECTION 13. The city of Boston shall pay the expenses incurred under sections ten, eleven and twelve of this act, except as otherwise provided in section ten of this act; and to meet said expenses the city treasurer of the city shall, from time to time, on the request of the mayor, issue and sell bonds of the city to an amount not exceeding eight hundred thousand dollars, and the bonds so issued shall not be reckoned in determining the legal limit of indebtedness of the city.

City treasurer to issue bonds, etc.

The Boston and Maine Railroad to remove certain structures, etc.

SECTION 14. The lock shall be built above the lower line of the dam, and the Boston and Maine Railroad shall, before the dam is completed, remove its bridge, piles and any other structures in Charles river which are southerly or westerly of a line defined in red on a plan filed in the office of the board of harbor and land commissioners marked "Plan showing line from above or southwest of which the Boston & Maine Railroad shall remove all of its structures in Charles River and between the harbor lines, May 25, 1903. Woodward Emery, Chairman of Harbor and Land Commissioners"; and may rebuild the same northerly and easterly of the line so defined. The draw in the new bridge shall not be easterly of nor more than fifty feet westerly from the location of the present draw, and shall be so located as to be directly opposite the lock. Within the limits herein prescribed the commission shall determine the position of the lock and draw.

Enforcement of provisions of act, etc.

SECTION 15. The supreme judicial court and the superior court shall, upon application of any party in interest, including any owner or occupant of property abutting on the basin or on Broad canal or Lechmere canal, have jurisdiction to enforce, or prevent violation of, any provision of this act and any order, rule or regulation made under authority thereof.

SECTION 16. Chapter three hundred and forty-four of the acts of the year eighteen hundred and ninety-one, as amended by section one of chapter four hundred and thirty-five of the acts of the year eighteen hundred and ninety-three, and chapter five hundred and thirty-one of the acts of the year eighteen hundred and ninety-eight are hereby repealed. Repeal.

SECTION 17. This act shall take effect on the first day of July in the year nineteen hundred and three. When to take effect.

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APPENDIX B.

CONTRACTS MADE DURING THE

	1. No. of Contract.	2. WORK.	3. No. of Bids.	AMOUNT OF BID. 4. Next to Lowest.	AMOUNT OF BID. 5. Lowest.	6. Contractor.
1	1	Dam and lock in the Charles River.	11	$801,607 50[1]	$761,900 00	Holbrook, Cabot & Rollins Corporation, Boston, Mass.
2	2	Wooden block paving for temporary bridge.	-[2]	-[2]	11,700 00	United States Wood Preserving Company, New York, N. Y.

[1] Contract based upon this bid.

Appendix B.

Year ending Sept. 30, 1905.

7. Date of Contract.	8. Date for Completion of Contract.	9. Date of Final Estimate.	10. Prices of Principal Items of Contract.	11. Amount of Contract.	12. Payments made to Sept. 30, 1905.	
Jan. 14, '05,	July 15, '08,	-	For coffer-dam at the Boston end of dam, $70,000; coffer-dam at the Cambridge end of dam, $27,000; earth excavation, $0.34, $0.38, $0.40, $0.41, and $0.45 per cu. yd.; coarse gravel, $0.75 per cu. yd.; broken stone or screened gravel, $1.50 per cu. yd.; riprap, $1.50 per ton of 2,000 lbs.; round piles in place, $0.24, $0.30, $0.14, $0.15 and $0.18 per lin. ft.; long-leaf yellow pine lumber, $60 per M. ft. B. M.; spruce lumber, $46, $50, and $35 per M. ft. B. M.; wrought iron and steel, $0.06 per lb.; cast iron and cast steel, $0.03 per lb.; concrete masonry, $6.50, $6, $4.50 and $5 per cu. yd.; ashlar masonry, $18 and $20.25 per cu. yd.; dimension stone masonry, $36 per cu. yd.; face dressing, $0.50 and $0.80 per sq. ft.; placing iron and other metal work, $25 per ton of 2,000 lbs.	$801,607 50	$101,930 12	1
Mar. 23, '05,	May 12, '05,	-	For furnishing and laying wooden block paving, $3 per sq. yd.	11,700 00	4,782 52	2

[2] Competitive bids were not received on this contract.

CONTRACTS MADE DURING THE YEAR

	1. No. of Contract.	2. WORK.	3. No. of Bids.	AMOUNT OF BID. 4. Next to Lowest.	AMOUNT OF BID. 5. Lowest.	6. Contractor.
1	3	Section 2 of the Boston marginal conduit.	10	$53,309 25	$50,600 00[1]	James Driscoll & Son, Brookline, Mass.
2	4	Cast-iron pipes and special castings.	2	6,590 12	5,640 75[1]	Camden Iron Works, Philadelphia, Pa.
3	5	Furnishing and erecting pumps.	2	9,533 00[1]	7,423 00	Henry R. Worthington, Boston, Mass.
4	6	Castings and other metal.	—[2]	—[3]	6,013 74	Gibby Foundry Company, East Boston, Mass.
5	7[3]	Yellow pine lumber for temporary bridge.	—[2]	—[2]	—[2]	George McQuesten Company, Boston, Mass.
6	8[3]	Granite paving blocks for temporary bridge.	3	1,960 00	1,923 25[1]	Rockport Granite Company, Rockport, Mass.

[1] Contract based upon this bid.

ENDING SEPT. 30, 1905 — *Continued.*

7. Date of Contract.	8. Date for Completion of Contract.	9. Date of Final Estimate.	10. Prices of Principal Items of Contract.	11. Amount of Contract.	12. Payments made to Sept. 30, 1905.	
June 13, '05,	Nov. 20, '05,	-	For earth excavation and refill, $8.50 and $7 per lin. ft. of trench; rock excavation, $5 per cu. yd.; piles, $0.14 per lin. ft.; underdrain, $0.75 per lin. ft.; concrete masonry, $7.50 and $3.75 per cu. yd.; iron and other metal work, $8 per ton of 2,000 lbs.; sheeting, $18 per M. ft. B. M.; crossings of Fruit and Cambridge street overflows, $8.	$50,600 00	$12,972 44	1
July 18, '05,	Sept. 16, '05,	-	For all standard straight pipe, $24.90 per ton of 2,000 lbs.; all standard special castings, $52.50 per ton of 2,000 lbs.; all special castings other than standard, $95 per ton of 2,000 lbs.	5,640 75	-	2
Sept. 30, '05,	Apr. 1, '06,	-	For furnishing and erecting Pump No. 1, $5,542; Pump No. 2, $2,525; Pump No. 3, $1,466.	9,533 00	-	3
July 27, '05,	Apr. 1, '06,	-	For iron castings unfinished, $0.0393 per lb.; finished iron castings, $0.0395 per lb.; finished steel castings, $0.1032 per lb.; composition, $0.43 per lb.; finished steel forgings, $0.0708 per lb.; wrought iron and steel rods, bolts, etc., $0.12 per lb.; rolled steel plates, $0.05 per lb.	6,013 74	-	4
Feb. 14, '05,	-	July 22, '05,	For Schedule No. 1, $30 per M. ft. B. M.; Schedule No. 2, $34 per M. ft. B. M.; Schedule No. 3, $34 per M. ft. B. M.; Schedule No. 4, $29 per M. ft. B. M.	12,476 58	12,476 58	5
Mar. 22, '05,	Apr. 12, '05,	June 15, '05,	For 35,000 granite paving blocks, $54.95 per thousand.	1,927 10	1,927 10	6

[2] Competitive bids were not received on this contract.

[3] Contract completed.

CONTRACTS MADE DURING THE YEAR

	1. No. of Contract.	2. WORK.	3. No. of Bids.	AMOUNT OF BID. 4. Next to Lowest.	5. Lowest.	6. Contractor.
1	9[1]	Granite edgestones for temporary bridge.	3	$532 00	$525 00[2]	New England Granite Company, Pigeon Cove, Mass.
2	10[1]	Motors for draw in temporary bridge.	-[3]	-[3]	812 50	General Electric Company, Boston, Mass.
3	11[1]	Spruce lumber for temporary bridge.	3	4,547 36	4,492 58[2]	E. D. Sawyer Lumber Company, East Cambridge, Mass.
4	12[1]	Tees for wheel-guard on temporary bridge.	2	891 54	728 09[2]	Harrington, Robinson & Company, Boston, Mass.
5	13	Twisted steel rods for reenforciug concrete.	2	5,219 20[2]	5,049 12[4]	Aberthaw Construction Company, Boston, Mass.
6	14	Castings for overflow, Boston marginal conduit.	3	749 00	736 80[2]	Gibby Foundry Company.
7	15	Composition at dam and lock.	3	1,821 00	1,773 44[2]	Coffin Valve Company, Neponset, Mass.
8	16	Brackets for lock gate bearings at lock.	2	1,343 33	1,301 30[2]	The Boston Bridge Works, Boston, Mass.
9	17	Welded pipe for electric conduits under lock.	3	4,385 00	3,965 00[2]	The Lumsden & Van Stone Company, Boston, Mass.
10	18	Gate valves at lock, .	3	861 95[2]	858 39[5]	The Ludlow Valve Manufacturing Company, Boston, Mass.
11	19	Plans, specifications, engineering and patent rights for superstructure, operating machinery, etc., for drawbridge over lock.	-[3]	-[3]	4,500 00[2]	The Scherzer Rolling Lift Bridge Company, Chicago, Ill.
12	Special Order.[1]	Machinery for draw in temporary bridge.	-[3]	-[3]	-[3]	H. J. Shaw, Cambridge, Mass.
		Totals, ...	. .	. . . .	. . . .	. . . . .

[1] Contract completed.

[2] Contract based upon this bid.

[3] Competitive bids were not received on this contract.

ENDING SEPT. 30, 1905 — *Concluded.*

7. Date of Contract.	8. Date for Completion of Contract.	9. Date of Final Estimate.	10. Prices of Principal Items of Contract.	11. Amount of Contract.	12. Payments made to Sept. 30, 1905.	
Mar. 22, '05,	Apr. 6, '05,	Apr. 17, '05,	For 700 lin. ft. of granite edgestones, $0.75 per lin. ft.	$525 00	$525 00	1
Mar. 22, '05,	Apr. 19, '05,	May 31, '05,	For the whole work, $812.50.	812 50	812 50	2
Mar. 23, '05,	Apr. 20, '05,	June 19, '05,	For 219,150 ft. B. M. spruce lumber, $20.50 per M. ft. B. M.	4,495 43	4,495 43	3
Mar. 29, '05,	Apr. 19, '05,	May 13, '05,	For about 3,020 ft. of tees, $0.0245 per lb.	817 08	817 08	4
May 29, '05,	Sept. 15, '05,	–	For about 126.4 tons square twisted steel rods, $2.05 and $2.25 per hundred lbs.	5,219 20	4,614 80	5
July 22, '05,	Sept. 1, '05,	–	For the whole work, $736.80.	736 80	–	6
July 31, '05,	Oct. 20, '05,	–	For Navy bronze, $0.30125 per lb.; Tobin bronze, $0.285 per lb.	1,773 44	2	7
Aug. 2, '05,	Oct. 20, '05,	–	For 31,000 lbs. steel, $0.0399 per lb.; pickling 8 tons, $8.05 per ton.	1,301 30	–	8
Aug. 18, '05,	Oct. 17, '05,	–	For the whole work $3,972.75.	3,972 75	–	9
Aug. 25, '05,	Apr. 1, '06,	–	For 30-inch valves, $202.75; 24-inch, $153 and $128.95; 20-inch, $112.80; 16-inch, $90.20; 14-inch, $55.50; 12-inch, $63.25; 8-inch, $22.50; 6-inch, $33.	861 95	–	10
Aug. 25, '05,	–	–	– –	4,500 00	–	11
Feb. 24, '05,	–	July 1, '05,	– –	3,785 13	3,785 13	12
. . .	. . .	. . .	. . . . .	$928,299 25	$149,141 05	

[4] Bid did not comply with requirements for delivery.
[5] Bid based on furnishing part sluice gates.